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EC 02-722 Nebraska's CNMP Manure Storage Management Workbook

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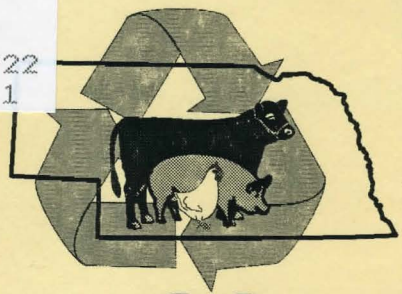
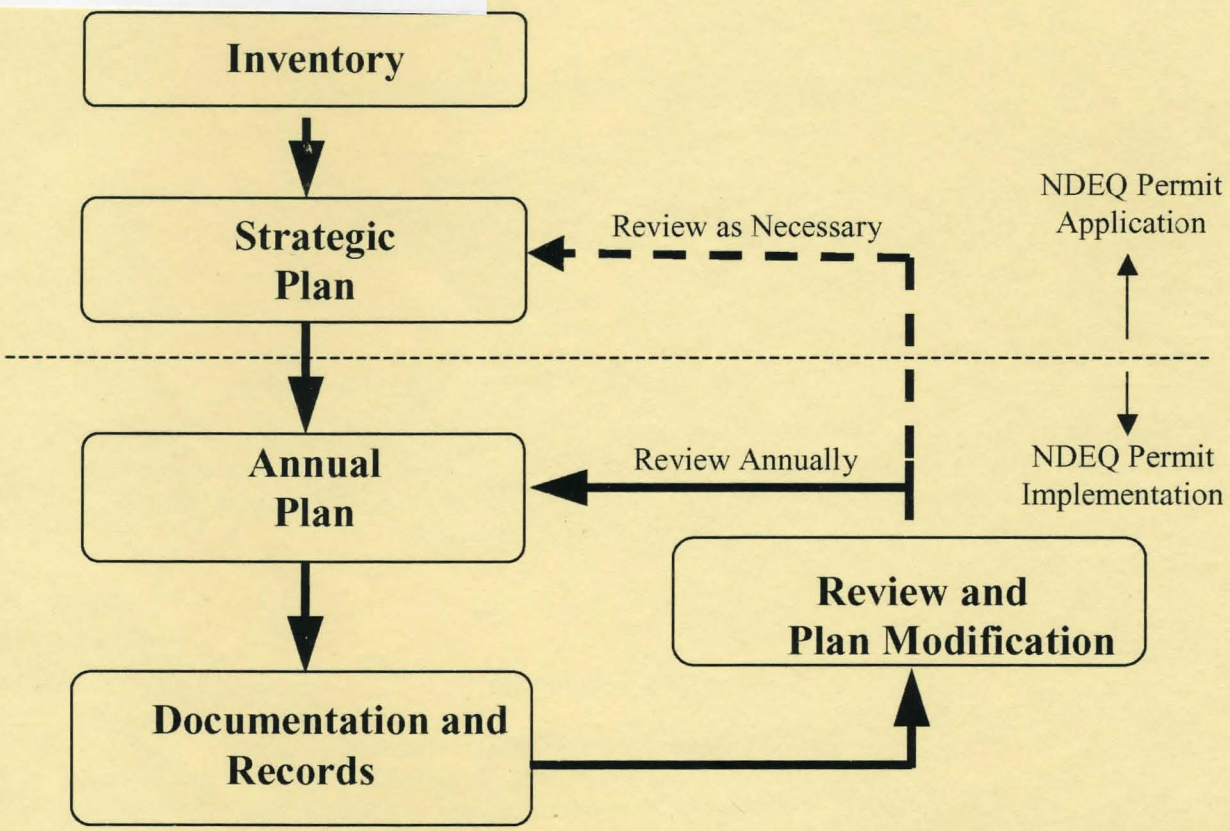


Nebraska's CNMP

Manure Storage Management Workbook



Developed by University of Nebraska Cooperative Extension

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University of Nebraska Lincoln

Nebraska's CNMP
Manure Storage Management Workbook

September 2003

To assist Nebraska livestock producers in developing and using their Comprehensive Nutrient Management Plan

Project Partners

University of Nebraska Cooperative Extension
Upper Elkhorn Natural Resources District
Lower Elkhorn Natural Resources District
Lower Platte North Natural Resources District

Cooperating Agencies and Organizations

Nebraska Cattlemen
Nebraska Pork Producers
Nebraska Department of Environmental Quality
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Nebraska's CNMP Manure Storage Management Workbook

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Table of Contents

What is a CNMP?

What is a CNMP? A Comprehensive Nutrient Management Plan (CNMP) is the environmental operating or management plan for a livestock or poultry facility. It is intended to encourage efficient management of nutrients in all aspects of a livestock system, environmentally and agronomically beneficial utilization of manures, and integration of nutrient management with other key environmental issues such as odor control or soil conservation planning.

Nutrients in manure, when managed incorrectly, represent the greatest single threat to water quality from livestock production. However, if managed correctly, manure is an environmental and agronomic asset. Soils receiving agronomic rates of manure require less commercial fertilizer (conserving energy and limited phosphorus reserves), are higher in organic matter (contributing to greater soil productivity and water storage capacity), and may experience less runoff, erosion, and nitrogen leaching. Thus, choices made relative to the management of manure nutrients within a livestock operation are absolutely critical.

What is the purpose of this workbook? This Nebraska CNMP workbook will assist a producer in the:

- preparation of a permit application to the Nebraska Department of Environmental Quality (NDEQ) for a CNMP addressing critical manure storage or runoff holding pond issues.
- development of planning procedures addressing operation and maintenance, emergency response, sludge management and closure.
- implementation of a management plan to insure regular storage inspection and record keeping routines that minimize environmental risks.

This workbook focuses on manure storage including runoff holding ponds. Separate CNMP workbooks focus on 1) manure application and 2) odor management planning. Additional references relevant to this workbook are listed on page 61.

How is the CNMP organized? The Nebraska CNMP is organized according to a five-step process (see cover):

- **Inventory.** Inventory records define current livestock or poultry numbers, manure storage and treatment facilities, and associated equipment required for an NDEQ permit.
- **Strategic Plan.** The Strategic Plan documents long-term plans for managing a manure storage suggested to address NDEQ permit requirements.
- **Annual Plan**. The Annual Plan is typically NOT part of the manure storage component of a CNMP.
- **Documentation and Records**. Records are used to verify a manure storage management plan's successful implementation and meet all NDEQ record keeping requirements.
- **Review and Plan Modification.** This final section reviews implementation of the storage management plan and determines if changes or modifications would improve the plan. No recommended planning documents are provided for this section.

Regulation vs. Good Stewardship? This workbook follows procedures accepted by NDEQ as part of their permit application and record keeping requirements. Those worksheet or record keeping forms marked with the Nebraska Department of Environmental Quality symbol *(Figure 1)* contain information that is mandatory for a NDEQ's permit application or follow-up NDEQ inspections.

Figure 1. Nebraska Department of Environmental Quality symbol.

At a minimum these planning tools (or comparable tools supplied by the producer or his/her advisor) are critical for insuring compliance with Nebraska regulations. Worksheets or record keeping forms marked with the "Good Stewardship" symbol *(Figure 2)* suggest recommended planning procedures for a farm's economic and environmental benefit.

Figure 2. The Good Steward symbol.

Summary of Management Plans and Records Required by Nebraska Department of Environmental Quality

Forms and Planning Procedures:	Page #	Form #	Permit Application		Records Keeping	
			Required	Com-pleted	Required	Currently Used
Introduction						
General Information	3	1	X			
Summary of Planning Recommendations	4	2				
Inventory						
Livestock and Poultry Inventory for Meat Production OR	8	3	X or			
Livestock Inventory for Milk, Egg and Wool Production	10	4	X			
Manure Volume Production:						
Manure/Bedding Volume Estimate for Solid Manure	12	5				
Manure Volume Estimate for Slurry or Liquid Systems	14	6				
Manure Volume Estimate for Process Water	16	7				
Total Manure Volume and Associated Calculations	18	8	X			
LWCF Inventory for:						
Anaerobic Lagoon	21	9a				
Earthen Manure Storage Basin	23	9b	X			
Formed Manure Storage	25	9c				
Runoff Holding Pond	27	9d				
Manure or Effluent Handling Equipment Inventory	30	10	X			
Strategic Plans						
Operation and Maintenance Plan for Manure or Runoff Storage	34	11	X			
Sludge and Sediment Management Plan	38	12	X			
Closure Plan for Earthen Storages	42	13	X			
Emergency Response Plan	46	14	X			
Annual Plan *(No Relevant Forms)*						
Documentation and Records						
Runoff Holding Pond Records (For Open Lot Systems Only)	51	15			X	
Manure Storage Inspection Checklist	52	16				
Manure Storage and Associated Equipment Maintenance Record	54	17			X	
Groundwater Monitoring Reports for Manure Storage	56	18			X	
Livestock Waste Discharge Notification	58	19			X	
Review and Plan Modification *(No Relevant Forms)*						

Form 1. General Information

(Please type or use black ink.)

Name of Livestock Operation: _____

Owner: _____ Phone: _____ / _____
Name (Home/Work)

_____ _____ _____ _____
Street, P.O. Box , or Route City State Zip Code

Authorized Representative: _____ Phone: _____ / _____
Name (Home/Work)

_____ _____ _____ _____
Street, P.O. Box, or Route City State Zip Code

Location of Facility:

_____ , _____ of _____ , _____ N, _____ (☐ E or ☐ W) _____ County
¼ ¼ Section Township Range

Technical Advisor: _____ Phone: _____ Fax: _____

_____ _____ _____ _____
Street, P.O. Box, or Route City State Zip Code

---For NDEQ Office Use Only ---

PE Seal, Date and Signature (If Required)

Owner or Representative Statement
The facilities described herein will be constructed, operated, and maintained as described in the attached application in accordance with title 130 regulations.

Owner: X _____ _____
Owner or Authorized Representative's Signature Date

Designer: X _____ _____
Designer's Signature Date

Form 2. Summary of Planning Recommendations

For the _____ **Animal Feeding Operation**

This summary is to be completed after completing the plan.

Part I. Manure Inventory Summary

List all appropriate manure handling systems and the annual estimated volume of manure handled by these systems.

	Manure or Runoff Water Source *(Forms 5* and *6)*	Manure Storage System Description *(Forms 5* and *6)*	Manure Quantity (tons, 1,000 gallons, or acre inches per yr.) *(Form 8)*
1.			
2.			
3.			

Part II. Management Plan Summaries

For each additional planning process completed (*Forms 11, 12, 13,* and *14*) summarize key features of the plan.

The _____ Management Plan: Summary of Key Recommendations

-
-
-

Form 2. Summary of Planning Recommendations

Part II. Management Plan Summaries (continued)

The _____ Management Plan: Summary of Key Recommendations

-
-
-

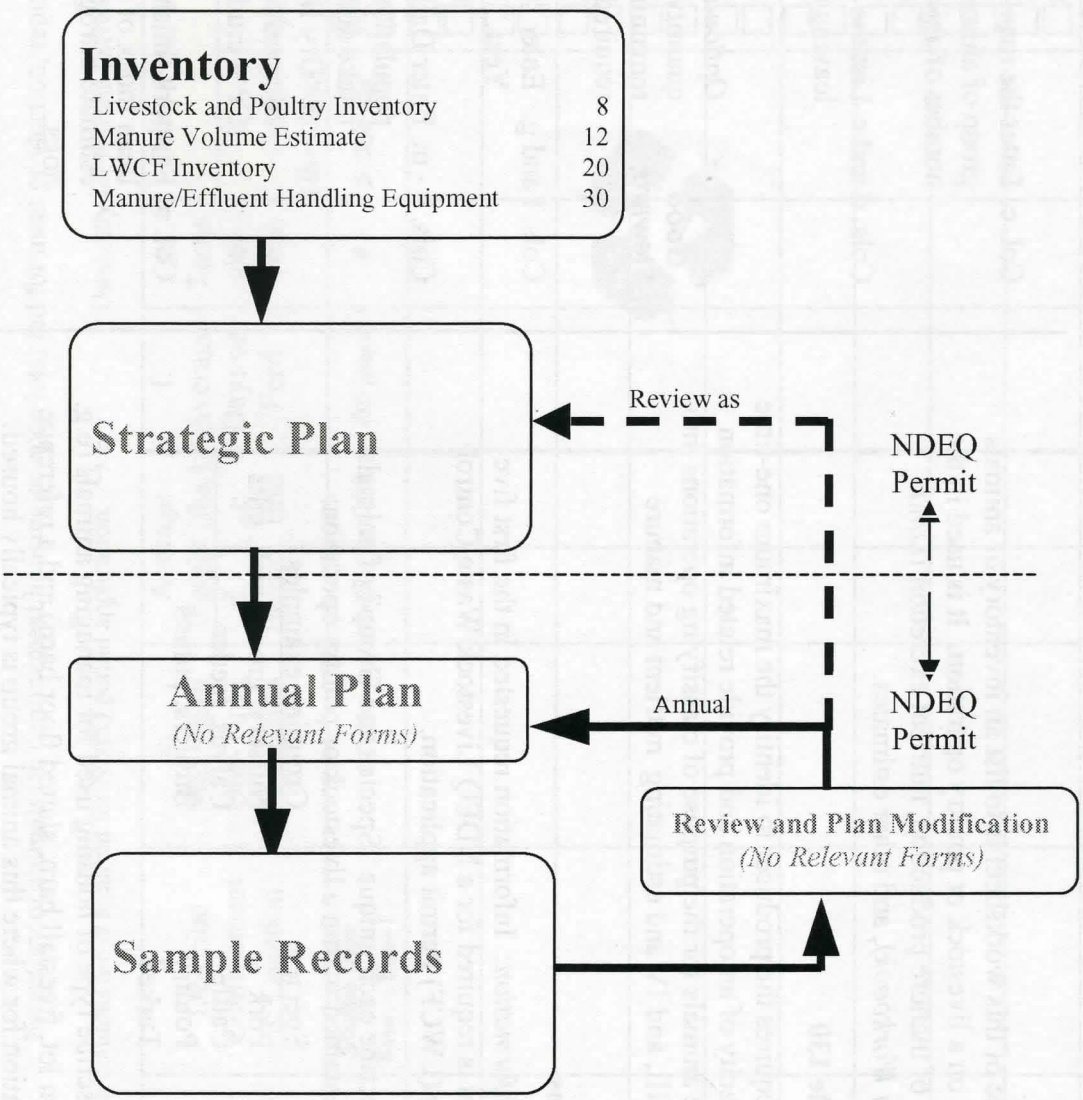
The _____ Management Plan: Summary of Key Recommendations

-
-
-

(Copy for additional Strategic Plan summaries.)

Nebraska's CNMP

Inventory of Resources



Instructions for Livestock and Poultry Inventory for Meat Production (Form 3)

Purpose

The purpose of this worksheet is to list an inventory of animals maintained on a livestock or poultry operation. It is used in the calculation of manure production, nutrient excretion *(Land Application Workbook)*, and other estimates.

NDEQ Title 130

Title 130 requires the producer to identify the maximum one-time animal capacity of an operation and provide related information about those animals for the purpose of classifying operations into Class I, II, III, and IV and estimating nutrient and manure excretion.

Instructions

Required Information: Information requested in the first five columns is required for a NDEQ Livestock Waste Control Facility (LWCF) Permit application.

Col. a. Describe each unique "Species and Group" of animals maintained within a livestock or poultry operation:

Species	Grouping examples
Pork	Nursery, grow/finish, gilts
Cattle	Calves, feeder
Poultry	Broilers, pullets
Turkey	

Col. b. Describe type of housing used for managing animals (e.g. open lot, freestall barn, slatted floor barn) and a reference location for where this animal group is typically housed.

Col. c. Enter the maximum one-time animal populations for this group of animals (do not use the annual throughput or number of animals finished in this facility).

Cols. d and e. List the average weight of animals entering and leaving this animal group.

Optional Information: To accurately estimate the quantity of nutrients excreted on an annual basis, the remaining requested information is valuable but not required by NDEQ.

Cols. f and g. Enter "Average Days on Feed" and "Turns per Year."

Cols. h - m. Enter Daily Feed Intake, based on maximum one-time population, and Feed Composition. Moistures for feed intake and composition can be entered on an "As Fed" or "Dry Basis." However, both intake and composition must be on the same moisture basis. CP = crude protein, P = phosphorus, K = potassium.

Col. n. For pork finishing production only, enter average Fat Free Lean Index of marketed hogs. This value is used to estimate nitrogen retention and excretion by grow/finish hogs.

Form 3. Livestock and Poultry Inventory for Meat Production

Inventory of animals (in confinement housing or open lots) fed for meat production, replacements, or reproduction.

← Information in columns a-e is required for NDEQ permit application. →← Used only for nutrient excretion estimates, not manure volume estimates. →

a. Species and Group	b. Describe Confinement & Location	c. Maximum One-Time Population	Average Weight (lbs.) d. Begin	Average Weight (lbs.) e. End	f. Average Days on Feed	g. Turns per Year	Daily Feed Intake h. Feed (lbs./day)[1]	Daily Feed Intake i. Moisture Basis	Feed Composition[1] % j. CP	Feed Composition[1] % k. P	Feed Composition[1] % l. K	Feed Composition[1] % m. Moisture Basis	n. Fat Free Lean Index[2]
Example: Pigs/Finish	*Slatted floor barn...Barn 1*	*1,000*	*45*	*250*	*110 days*	*3*	*5,350 lbs.*	☒ As Fed ☐ Dry	*17%*	*0.6%*	*1%*	☒ As Fed ☐ Dry	
1.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
2.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
3.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
4.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
5.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
6.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
7.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
8.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
9.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	
10.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry	

1. Both daily feed intake and feed composition should be measured on the same moisture basis (e.g. both on an "as fed" basis).
2. Fat free lean index is needed for pork finishers only. This measure should be available for market hogs at the time of slaughter.

Instructions for Livestock and Poultry Inventory for Milk, Egg, and Wool Production (Form 4)

Purpose

The purpose of this worksheet is to list an inventory of animals maintained for dairy or egg production. It is used in the calculation of manure production, nutrient excretion *(Land Application Workbook),* and other estimates.

NDEQ Title 130

Title 130 requires the producer to identify the maximum one-time animal capacity of an operation and provides related information about those animals for the purpose of classifying operations into Class I, II, III, and IV and estimating nutrient and manure excretion.

Instructions

Required Information: Information requested by the first five columns is required for a NDEQ Livestock Waste Control Facility Permit application.

Col. a. Describe each production animal Species and Group:

Species	Grouping examples
Dairy	Lactating, dry, replacement heifer, bull
Pork	Gestating sow, sow & liter, boar
Cattle	Cow, bull
Poultry	Layers, turkeys

Col. b. Describe type of housing used for managing animals (e.g. open lot, freestall barn, slatted floor barn) and a reference location for where this animal group is typically housed.

Col. c. Enter the maximum one-time animal population for this group of animals. An average is not required.

Col. d. List the days per year that the facility is occupied.

Col. e. List the average weight of animals in this animal group.

Optional Information: To accurately estimate the quantity of nutrients excreted on an annual basis, the remaining requested information is valuable, but not required by NDEQ.

Cols. f and g. Enter the average annual production levels for wool, milk, and eggs.

Cols. h and i. Enter Daily Feed Intake based on the maximum one-time population. Feed intake and composition can be entered on an "As Fed" or "Dry Basis". However, both intake and composition must be on the same moisture basis.

Cols. j, k, l, and m. Feed Composition in percentage: CP = crude protein, P = phosphorus, K = potassium

Form 4. Instructions for Livestock and Poultry Inventory for Milk, Egg, and Wool Production

← Information in Columns a-e is required for NDEQ permit application. →← Used only for nutrient excretion estimates, not manure volume estimates. →

a. Species/Group	b. Describe Confinement & Location	c. Maximum & Average One-Time Populations	d. Days per Year Facility Is Occupied	e. Average Weight (lbs. per animal)	Average Production		Daily Feed Intake		Feed Composition[1] %			
					f. Lbs./ animal/ yr	g. Product	h. Feed (lbs./ day)[1]	i. Moisture Basis	j. CP	k. P	l. K	m. Mois-ture
Example: Dairy/lactating cows	*Freestall...Barn 3*	*600*	*365*	*1425 lbs.*	*27,000*	*Milk*	*5,350 lbs.*	☒ As Fed ☐ Dry	*16%*	*0.55%*	*1%*	☒ As Fed ☐ Dry
11.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
12.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
13.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
14.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
15.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
16.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
17.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
18.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
19.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry
20.								☐ As Fed ☐ Dry				☐ As Fed ☐ Dry

1. Both daily feed intake and feed composition should be measured on the same moisture basis (eg. both on an "As Fed" basis).

Manure Volume Estimate
Instructions for Solid Manure Systems (Form 5)

Purpose

The purpose of this worksheet is to estimate the volume of manure produced by livestock housed with solid or dry manure systems. This estimate may have been completed as part of the engineering permit application documents prepared for a facility. If so, those estimates may be submitted in place of the following procedures.

NDEQ Title 130

Title 130 requires an estimate of manure production for sizing the manure storage facilities. In addition, this estimate is important to the Operation and Maintenance Plan for your manure storage facility and land application equipment (review of existing equipment's ability to handle the volume of manure produced). The estimate of total manure volume (or weight) completed in *Form 8* can be used to judge the adequacy of available land application equipment for handling anticipated manure production. *Form 5* provides one alternative of estimating manure production.

Instructions

Step 1. Identify the manure storage system used on this livestock operation. **A separate worksheet should be used for each manure handling system used on this livestock operation.** For example, if the manure from a dairy replacement group of animals collects in a bedded pack and the manure from the lactating dairy herd is stored in an outdoor pit, a separate worksheet should be used for animals supplying manure to the bedded pack (*Form 5,* solid manure) and the outdoor pit (*Form 6,* liquid manure). The totals should be kept separate.

Step 2. Choose between Part A and B for estimating solid manure production. For estimating solid manure production, Part A provides a reasonable approximation of harvested manure if evaporation and drained liquids are not significant during storage. Part B is preferable for storage systems where manure characteristics change significantly between time of excretion and time of manure harvesting. If your animal housing/manure handling system is listed in Part B, these values are generally preferable.

Step 3. Enter required data for each livestock or poultry group providing manure to the identified manure storage system. The user must enter the following values:

- Col. b OR Col. i: Maximum one-time animal population (should match *Forms 3* or *4*).
- Col. e: Tons of bedding per animal space per year.

Step 4. Complete the following calculations.

- Col. d Total manure produced per year = Col. b x Col. c
- Col. f Total bedding used per year = Col. b x Col. e
- Col. g Total manure and bedding added per year = Col. d + Col. f
  OR
- Col. k Total manure, bedding, and/or soil removed per year = Col. i x Col. j

Step 5. Sum manure and bedding production. Sum manure production for all groups of animals supplying the same manure handing system (Col. g) and record in Cell h.

Additional Information

NRCS *Agricultural Waste Management Field Handbook* (Chapter 4), available online at www.ncg.nrcs.usda.gov/awmfh.html.

Manure Characteristics, MWPS-18 (Section 1): Order online at http://www.mwpshq.org/ or by calling 1-800-562-3618.

Form 5. Manure Volume Estimate for Solid Manure Systems.

Manure storage system: _____

Part A. Suggested for solid manure systems with little or no evaporation or drainage of liquids.

a. Livestock or Poultry Group	b. Maximum One-Time Capacity (# of animals)	Manure Weight		Bedding Weight		g. Total Manure and Bedding Added Per Year (Tons/Yr) (d + f)
		c. Manure Produced Per Animal Space / Year (Tons/Yr)	d. Total Manure Produced (Tons/Year) (b x c)	e. Bedding Use Per Animal Space / Year (Tons / Yr.)	f. Total Bedding Use (Tons/Year) (b x e)	
Example : Swine...Finish	*250*	*1.1*	*275*	*0.2*	*50*	*325*
Swine Nursery		0.24				
Grow/Finish		1.1				
Sows and Litter		2.4				
Sows (gestation)		1.0				
Gilts		1.5				
Boars		1.0				
Beef (450-750 lbs.)		3.5				
Beef Finisher (>750 lbs.)		5.9				
Beef Cow		6.7				
Dairy Cow		14.0				
Heifer/Calves		6.5				
Layer		0.019				
Pullet		0.011				
Broiler		0.009				
Turkey		0.023				
TOTAL:						h.

Part B. This form is based on measured estimates of manure, bedding, and/or soil removal for a few common livestock and poultry systems that handle manure as a solid. This table is preferable for solid manure unless your system is not listed.

a. Livestock or Poultry Manure Handling System	i. Maximum One-Time Capacity (No. of Animals)	Manure Weight	
		j. Manure, Bedding, and/or Soil Removed Per Animal Space Per Year (Tons / Yr.)	k. Total Manure, Bedding and/or Soil Removed (Tons/Year) (i x j)
Swine Grow/Finish, Hoop Barn		0.5	
Swine Grow/Finish, Hoop Barn + Composting)		0.2	
Feedlot for Finish Cattle		2.2 *	
High Rise Layer House		0.011	

- Highly variable depending on lot cleaning practices, manure moisture content, and soil mixed with manure. Assumes one ton of solids removed per finished beef animal.

Manure Volume Estimate: Instructions for Slurry or Liquid Systems (Form 6)

Purpose

The purpose of this worksheet is to estimate the volume of manure produced by livestock for slurry or liquid manure systems This estimate may have been completed as part of the engineering permit application documents prepared for a facility. If so those estimates may be submitted in place of the following procedures.

NDEQ Title 130

Title 130 requires an estimate of manure production for sizing of the manure storage facilities. In addition, this estimate is important to the Operation and Maintenance Plan for your manure storage facility (locating critical pumping levels for a staff gauge) and land application equipment (review of existing equipment's ability to handle the volume of manure produced). *Forms 5, 6* and *7* provide one alternative for estimating manure production, and *Form 8* can contribute to an estimate of minimum storage needs and adequacy of available land application equipment.

Instructions

Step 1 Identify the manure storage system used on this livestock operation. **A separate worksheet should be used for each manure handling system used on this livestock operation.** For example, if the manure from the sow herd feeds an anaerobic lagoon and the manure from the grow/finish hogs is stored in a below-floor pit, a separate worksheet should be used for the animals supplying manure to the anaerobic lagoon and another form for the below-floor pits. The totals should be kept separate.

Step 2. Enter required data for each livestock or poultry group providing manure to the identified manure storage systems. The user must enter the following values:

- Col. b: Maximum one-time animal population,
- Col. c: Average animal weight,
- Col. e: Days per year that the animal housing facility is occupied. The review by NDEQ will typically assume that a livestock facility is occupied at capacity 365 days per year.

Step 3. Complete the following calculations

- Col. d: Total animal weight at one time = Col. b x Col. c ÷ 1000
- Col. g: Total manure volume per year = Col. d x Col. e x Col. f
- Col. h: Total manure weight per year = Col. g ÷ 32 (converts cubic feet into tons)

Step 4. Sum manure volume and weight. Sum manure production for all groups of animals supplying the same manure handing system and record total volume in Cell j, and total weight in Cell k. To convert cubic feet to gallons, use the following formula:

- Cell l: Total manure volume in gallons = Cell j x 7.5

Additional Information

NRCS Agricultural Waste Management Field Handbook (Chapter 4) available online at www.ncg.nrcs.usda.gov/awmfh.html.

Manure Characteristics, MWPS-18, is available from University of Nebraska-Lincoln Communications and Information Technology, (402) 472-9713, or online at www.mwpshq.org/.

Form 6. Manure Volume Estimate for Slurry or Liquid Manure Systems

Manure storage system: _____

Manure and urine production

a. Livestock or Poultry Species	b. Maximum One-Time Capacity (# of animals)	c. Average Animal Weight (lb.)	d. Total Animal Weight (b X c ÷ 1,000) (1,000 lbs.)	e. Days per Year that Facility is Occupied[1]	Manure & Urine Volume		h. Manure Weight (tons/yr.) (g ÷ 32)
					f. Ft^3 per 1,000 lb. Animal Weight Per Day	g. Total (ft^3/yr.) (d X e X f)	
Example : Swine...Finish	*2000*	*150*	*300*	*345*	1.0	*103,000*	*3,200*
Swine Nursery					1.7		
Grow/Finish					1.0		
Sows and Litter					0.96		
Sows (Gestation)					0.44		
Gilts					1.0		
Boars					0.33		
Beef (450-750 lb.)					0.93		
Beef feeder (High Energy Diet)					0.82		
Beef feeder (High Forage Diet)					0.95		
Beef Cow					1.0		
Dairy Cow...50 lb./d					1.4		
Dairy Cow...70 lb./d					1.8		
Dairy Cow...100 lb./d					2.2		
Dry Cow (Dry)					0.92		
Heifer/Calves					1.3		
Layer					0.93		
Pullet					0.73		
Broiler					1.26		
Turkey					0.69		
Total					j. ft^3/yr		k. tons/yr
					l. gal/yr^2		

[1] NDEQ assumes that the facility is operated at full capacity 365 days per year in their review of a permit application.
[2] For gallons/year, multiply ft^3/year by 7.5.

Form 7.
Instructions for Process Water Used for Facility Cleaning and Manure Handling

Purpose

The purpose of this worksheet is to estimate the volume of process water produced by livestock for slurry or liquid manure systems. This estimate may have been completed as part of the engineering permit application documents prepared for a facility. If so, those estimates may be submitted in place of the following procedures.

NDEQ Title 130

Title 130 requires an estimate of manure production for sizing of the manure storage facilities. In addition, this estimate is important to the Operation and Maintenance Plan for your manure storage facility (locating critical pumping levels for a staff gauge) and land application equipment (review of existing equipment's ability to handle the volume of manure produced). *Forms 5, 6* and *7* provide one alternative for estimating manure production and *Form 8* can contribute to an estimate of minimum storage needs and adequacy of available land application equipment.

Instructions

Estimate process water use by following the steps outlined in *Form 7* for a milking center (Part A), flush alley for dairy barn (Part B), or cleanup or flush water in swine housing (Part C). If water meter records or reasonable estimates of water use are available, those estimates should be used in place of the approximations made in *Form 7.*

Additional Information

NRCS Agricultural Waste Management Field Handbook (Chapter 4) available online at www.ncg.nrcs.usda.gov/awmfh.html

Manure Characteristics, MWPS-18, order from University of Nebraska-Lincoln Communications and Information Technology, (402) 472-9713, or online at www.mwpshq.org/.

Form 7.
Process Water Used for Facility Cleaning and Manure Handling

This form should be used only to estimate clean water usage in the calculation of manure and process water volumes. Recycled water from a pit or lagoon should not be included. If individual farm water meter records or estimates are available, they should be used in place of this table's approximations.

Part A. Approximate Milking Center Fresh Water Volume.

a. Maximum One-Time Capacity (# of animals)	b. Average Animal Weight (lb.)	c. Total Animal Weight-1000 lbs. (a x b ÷ 1000)	Dilution Water Volume: circle one (ft^3/day/1000 lb. of animal weight) d. Around the Barn Pipeline	e. Milking Parlor (MP)	f. MP + Holding Area[1]	g. MP + Holding Area[2]	Total Annual Water Volume h. Cubic Feet/Year (c x circled value x 365)	i. Gallons/Year (h x 7.5)
Ex. 300	1400	420	☐ 0.22	☐ 0.6	☑ 1.4	☐ 1.6	215,000 ft^3/yr	1,600,000 g/yr
			☐ 0.22	☐ 0.6	☐ 1.4	☐ 1.6		

Part B. Approximate Fresh Water Volume for Flushing Alleys in Dairy Barn.[3]

j. Dairy Barn	k. Width of All Freestall Alleys (feet)	l. Number of Flushes Per Day (typically 2 to 3)	m. Flush Water Volume (ft^3./ft. of alley width/flush)	Total Water Volume n. Cubic Feet/Year (k x 1 x m x 365)	o. Gallons/Year (n x 7.5)
Example: 6 row barn, 2% slope	48	3 flushes	100	5,300,000 ft^3/yr	39,000,000 gal/yr
1 % Alley Slope			175		
1.5 % Alley Slope			125		
2 % Alley Slope			100		
2.5 % Alley Slope			90		

Part C. Approximate Fresh Water Volume Used in Swine Housing for Alley Flushing and General Cleanup.[3]

p. Type of Animals	q. Number of Animals (One-Time Capacity)	r. Days Per Year that Facility is Occupied	Water use: circle one (ft^3/head-day)4 s. Flush System	t. Pull Plug System	u. Below Barn Pit or Scraper	v. Your Own Number	Total Water Volume w. Cubic Feet/Year (q x r x Checked Value or v)	x. Gallons/Year (w x 7.5)
Example: Grow/Finish	2000	350	☐ 1.6	☑ 0.6	☐ 0.03		420,000 ft^3/yr	3,200,000 g/y
Swine Nursery			☐ 0.4	☐ 0.2	☐ 0.009			
Grow/Finish			☐ 1.6	☐ 0.6	☐ 0.03			
Sows and Litter			☐ 3.6	☐ 1.4	☐ 0.07			
Sows (Gestation)			☐ 1.1	☐ 0.4	☐ 0.024			
Gilts			☐ 2.1	☐ 0.8	☐ 0.04			
Boars			☐ 1.1	☐ 0.4	☐ 0.023			

Part D. Total Water Added to Manure in Animal Housing

Cell y = sum of columns h, n, & w Cell z = sum of columns i, o, & x

y. ft^3/yr z. gal/yr

1 Holding area scraped and flushed—solid manure excluded.

2 Holding area scraped and flushed—solid manure included.

3 These estimates assume fresh water is used for cleaning, flushing, and/or pit recharging. If recycled water is used, then the portion that is recycled water should be subtracted from these estimates.

4 Assumes that water addition by flush system and pull plug systems dilutes manure to 1 percent and 2.5 percent solids, respectively. Below-barn pit and scraper assumes dilution water is assumed to be 20 percent of manure and urine volume.

Instructions for Manure Volume Estimate: Total Volume and Associated Calculations (Form 8)

Purpose

The purpose of this worksheet is to estimate the total volume of manure and process water produced by livestock. This estimate may have been completed as part of the engineering permit application documents prepared for a facility. If so, those estimates may be submitted in place of the following procedures. These values can be used to estimate land application equipment operating requirements (number of loads, operating hours) and minimum storage volumes required for setting Must Pump and Pre-Winter Must Pump marks on a staff gauge.

NDEQ Title 130

Title 130 requires an estimate of manure production for sizing of the manure storage facilities. In addition, this estimate is important to the Operation and Maintenance Plan for your manure storage facility (locating critical pumping levels for a staff gauge) and land application equipment (review of existing equipment's ability to handle the volume of manure produced).

Instructions

Step 1. Sum all manure and process water *(Form 5* for solid manure systems and *Form 6* and *7* for slurry and liquid manure systems) and record in *Form 8 (Step 1).*

Step 2. What is the minimum storage volume *(Form 8, Step 2)*? This procedure can be used for formed manure storages, earthen storages, and anaerobic lagoons only. It is not applicable to runoff holding ponds. This information can be used in completing *Forms 9a, b,* and *c.*

Step 3. What equipment and time is required for transporting and land applying manure with a box spreader or slurry tank *(Form 8, Step 3)*? This information can be used to complete *Form 11.*

Step 4. How much time is required for pumping slurry or liquid manure through an irrigation or towed hose application unit *(Form 8, Step 4)*? This information can be used to complete *Form 11.*

Form 8. Manure Volume Estimate: Total Volume and Associated Calculations

Step 1. Total manure, urine, and process water volume or weight:

a. Source	b. Manure Volume (Form 6, cell j or l)	c. Process Water Volume (Form 7, cell y or z)	d. Total Volume[1] (b+c) or Total Weight (Form 5)
Slurry or Liquid Manure (ft^3 or gal./yr)			
Solid Manure (tons/yr.)			

Step 2: Minimum storage volume for slurry and liquid storage systems.

	Total Manure & Water Volume (Step 1d)	x	Minimum Storage Period	÷	365 days/yr	=	Minimum Storage Volume
Ex.	550,000 ft^3 per year	x	180 day	÷	365	=	270,000 ft^3
		x		÷	365	=	

Step 3. Loads and time requirements for transporting and land applying manure.

	Total Manure & Water Volume or Weight (Step 1d)	÷	Spreader Capacity Gallons or Ft^3 Per Load	=	Spreader Loads Per Year
Ex.	10,000 ton of solid manure	÷	20 ton / load	=	500 loads
		÷		=	

	Spreader Loads Per Year	x	Average Round Trip Time (hours)	=	Time Required for Land Application
Ex.	500 loads	x	0.5 hour / load	=	250 hours
		x		=	

Step 4. Pumping time for land applying liquid manure.

	Total Manure & Water Volume (Step 1d)	÷	Irrigation Pump Capacity (gpm)	÷	60 min/hr Per Year	=	Pumping Time (hours)
Ex.	550,000 ft^3/yr x 7.5 =						
	4,215,000 gal./yr.	÷	300 gpm	÷	60	=	31 hours
		÷		÷	60	=	

[1] *To convert from cubic feet to gallons, multiply by 7.5.*

Instructions for LWCF* Inventory (Form 9)

Purpose

This worksheet is intended to:

1. Inventory the characteristics of planned or existing manure storage facilities.
2. Identify the critical lagoon levels against which liquid levels are to be compared and managed.

NDEQ Title 130

For a new livestock waste control facility (LWCF), NDEQ requires documentation of the sizing, engineering design, and construction quality assurance. The design engineer or consultant typically assembles this information as part of the construction permit application. In addition, LWCFs are subject to several management expectation including managing liquid levels relative to two critical maximum storage levels, a maximum liquid level for year round operation and for entering winter. The summary tables in this section are intended to summarize characteristics and critical liquid levels of LWCFs.

Instructions

Step 1. For each manure storage facility located within a livestock operation, select from four options including: 1) Anaerobic lagoon (Form 9a), 2) Earthen manure storage (Form 9b), 3) Formed manure storage (Form 9c), or 4) Runoff holding pond (Form 9d). Copy one worksheet for each storage facility located within a farm.

Step 2. Enter the appropriate characteristics of that storage.

- *Col. a.* Identify the animals supplying manure and/or storm related runoff water to this storage structure. You may enter the reference number assigned to animal groups listed in column 'a' on Forms 3 or 4.
- *Col.b.* Enter the depth from the bottom of the storage structure down to the high seasonal groundwater level.
- *Col. c.* Enter the down-gradient drainage distance between storage and nearest surface water down gradient from manure storage.
- *Col. d.* Enter the total capacity of the storage structure. If unknown, check with the individual or organization who designed the facility, engineering drawings for the facility, or a NDEQ permit application for this facility. To convert gallons to cubic feet, divide gallons by 7.5.
- *Col. e.* It is important to recognize what portion of the total volume is useable for storage, and the related depths at which removal of storage contents should begin and end. Record useable storage volume in Column e.
- *Col. f.* Storage facilities for manure, process water, and/or storm water runoff can perform more than one function. Use this column to define the storage structures functions including manure and urine storage, process water storage (e.g. barn cleaning, alley flushing, milking center cleaning, pit recharge), precipitation related runoff storage, and/or treatment (e.g. solids settling, anaerobic decomposition).

Step 3. Briefly describe the typical management of each storage facility, including timing of manure removal and method for determining when to start and stop pumping.

Step 4. Using the appropriate drawing, identify the critical depths for the indicated staff gauge levels and key storage volumes. Background information on the backside of each type of storage worksheet provides a written explanation of these volumes and levels.

* LWCF: Livestock Waste Control Facility

Form 9a. LWCF* Inventory - Anaerobic Lagoon(s)

Additional information on anaerobic lagoons found on page 22.

Anaerobic Lagoon Characteristics: Facility ID: _____

a. Animals Contributing to Facility	b. Depth to Ground Water	c. Distance to Surface Water	Storage Volume		f. Purpose of Facility: In addition to storage and treatment of manure, is this facility used for:	
			d. Total Volume (cubic feet)	e. Useable Storage Volume	Storage of Process Water from:	Storage of Runoff Water
Example: 1, 3, & 4	*50+ ft.*	*¼ mile*	*2,000,000 ft³*	*750,000 ft³.*	*animal housing cleaning & pull plug pit recharge*	☐ Yes _____ acres ☒ No
						☐ Yes _____ acres ☐ No

Summary of Typical Management:

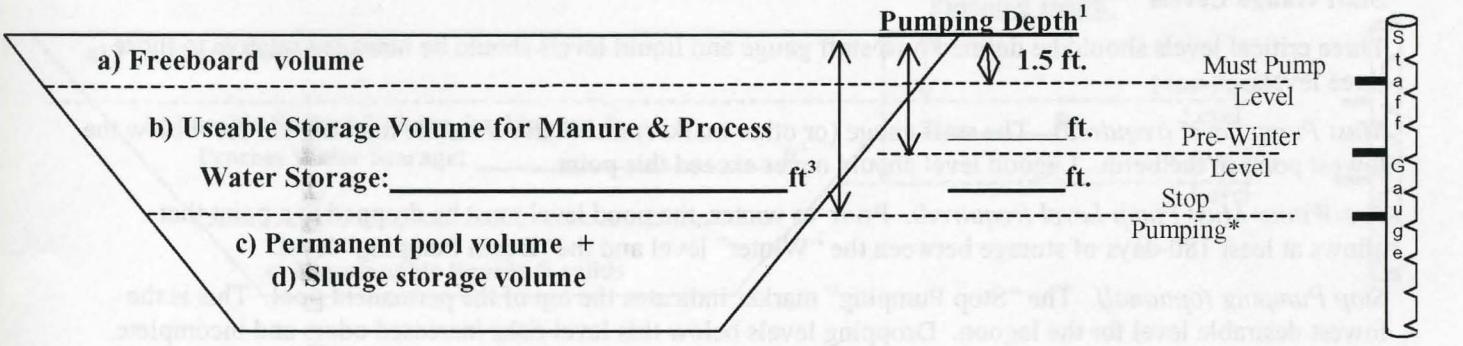
_____

_____

_____

_____

Storage Volumes & Critical Storage Levels :



* Recommended for anaerobic lagoon but not required by law.

- LWCF: Livestock Waste Control Facility

Background Information on Anaerobic Lagoons (Form 9a, continued)

An **anaerobic lagoon** is a structure designed for storage and treatment purposes. It is commonly used on dairy and swine operations where sufficient volume is provided for storage of manure and urine for a six-month (minimum under NDEQ regulations) to a one-year period. An additional permanent pool is maintained in the lagoon to provide a bacterial seed and dilution benefit for processing the regular additions of manure and urine.

Primary Volumes in an Anaerobic Lagoon

Freeboard. This is the level above which the liquid should not rise under any normal conditions. It sets the maximum liquid level for year round operation for an anaerobic lagoon. NDEQ requires 1.5 feet for earthen storage facilities.

Useable Storage Volume. A manure storage should provide sufficient volume to eliminate the need for winter application of manure and process water. The NDEQ minimum is a 180-day storage period. For existing facilities, this requirement can be waived if the producer can document the ability to manage a smaller size storage. However, many systems are designed with greater volume than the minimum. For example, storage systems used to spread effluent by irrigation often provide sufficient storage volume to allow most effluent application during the cropping season.

Permanent Pool. The permanent pool (used in anaerobic lagoons, only) provides a minimum treatment volume for treating solids and stabilizing odors. NDEQ sets a maximum loading rate of 4 lbs. of volatile solids per 1000 cubic feet of volume per day. Lower rates are acceptable and have odor control benefits.

Sludge Storage. In anaerobic lagoons, manure solids and sludge build up with time. Sludge storage volumes are based upon the intervals between sludge removal and an estimate of the rate of sludge accumulation.

Staff Gauge Levels

Three critical levels should be defined on a staff gauge and liquid levels should be managed relative to those three levels.

Must Pump Level (required). The staff gauge (or other marker) must have a visible marking 1.5 feet below the lowest point in the berm. Lagoon level should never exceed this point.

Pre-Winter Must Pump Level (required). Prior to winter, the pond level must be dropped to a point that allows at least 180-days of storage between the "Winter" level and the "Begin Pumping" level.

Stop Pumping (optional). The "Stop Pumping" marker indicates the top of the permanent pool. This is the lowest desirable level for the lagoon. Dropping levels below this level risks increased odors and incomplete processing of solids manure. In some designs, the "Pre-Winter Level" and "Stop Pumping" levels may be the same depth.

Form 9b. LWCF* Inventory – Earthen Manure Storage Basin

Additional information on earthen basins found on page 24.

Earthen Manure Storage Basin Characteristics: Facility ID: _____

a. Animals Contributing to Facility	b. Depth to Ground Water	c. Distance to Surface Water	Storage Volume		f. Purpose of Facility[1]: In addition to storage of manure and urine, is this facility used for:	
			d. Total Volume (cubic feet)	e. Useable Storage Volume	Storage of Process Water from:	Storage of Runoff Water?
Example: 1, 3, & 4	*50+ ft.*	*¼ mile*	*1,000,000 ft³*	*750,000 ft³.*	*animal housing cleaning & pull plug pit recharge*	☐ Yes _____ acres ☒ No
						☐ Yes _____ acres ☐ No

1. If a manure storage basin is used to perform treatment functions, it should likely be considered an anaerobic lagoon.

Summary of Typical Management:

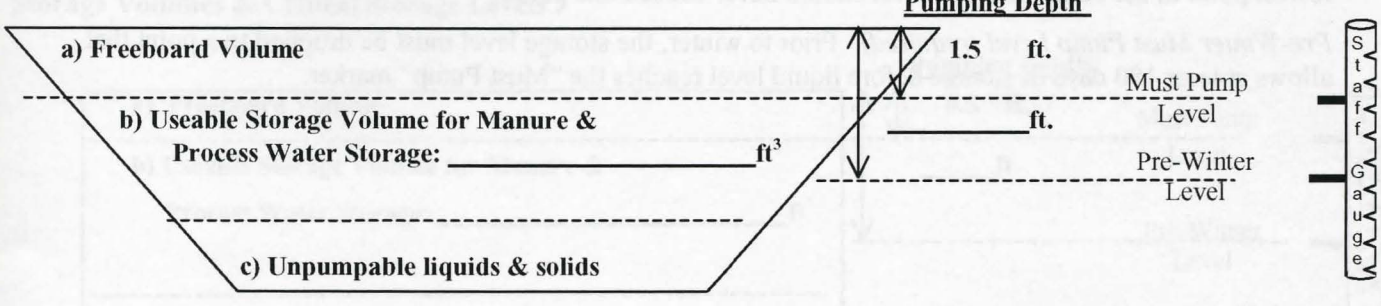
_____

_____

_____

_____

Storage Volumes & Critical Storage Levels :



*LWCF: Livestock Waste Control Facility

Background Information on Earthen Manure Storage Basins (Form 9b, continued)

An **Earthen Manure Storage Basin** is a structure designed for storage purposes only. It is commonly used on dairy and swine operations. Sufficient volume should be provided to store all manure, urine, and process water for a six-month (minimum under NDEQ regulations) to a one-year period. No volume is included for treatment of manure and generally no volume is included for collecting open lot runoff.

Primary Volumes in a Manure Storage Basin

Freeboard. This is the level above which the liquid should not rise under any normal conditions. It sets the maximum liquid level for year round operation for a storage basin. NDEQ requires 1.5 feet for earthen storage facilities.

Useable Storage Volume. A manure storage should provide sufficient volume to eliminate the need for winter application of manure and process water. The NDEQ minimum is a 180-day storage period. For existing facilities, this requirement can be waived if the producer can document the ability to manage a smaller sized storage. However, some systems are designed with greater volume than the minimum to provide greater flexibility in application timing.

Unpumpable Liquids and Solids. Due to equipment limitations and solids accumulation, at least one foot of depth is generally considered unavailable for manure storage.

Key Staff Gauge Levels

Must Pump (required). The staff gauge (or other marker) must have a visible marking 1.5 feet below the lowest point in the berm. Storage level should never exceed this point.

Pre-Winter Must Pump Level (required). Prior to winter, the storage level must be dropped to a point that allows at least 180 days of storage before liquid level reaches the "Must Pump" marker.

Form 9c. LWCF* Inventory – Formed Manure Storage

Additional information on formed storage found on page 26.

Formed Manure Storage Characteristics: Facility ID: _____

a. Animals Contributing to Facility	b. Depth to Ground Water	c. Distance to Surface Water	Storage Volume		f. Purpose of Facility[1]: In addition to storage of manure and urine, is this facility used for:	
			d. Total Volume (cubic feet)	e. Useable Storage Volume	Storage of Process Water from:	Storage of Runoff Water?
Example: 1, 3, & 4	*50+ ft.*	*¼ mile*	*800,000 ft³*	*750,000 ft³.*	*animal housing cleaning & pull plug pit recharge*	☐ Yes _____ acres ☒ No
						☐ Yes _____ acres ☐ No

1. If a formed manure storage is used to perform treatment functions, it should likely be considered an anaerobic lagoon.

Summary of Typical Management:

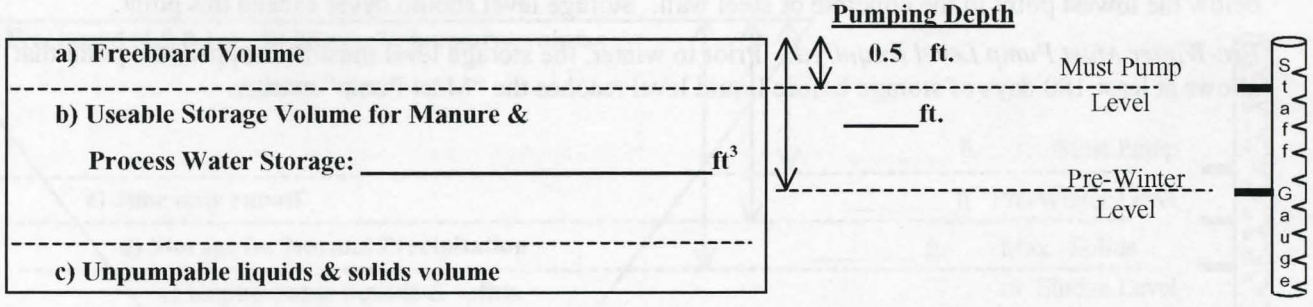
_____

_____

_____

_____

Storage Volumes & Critical Storage Levels :



*LWCF: Livestock Waste Control Facility

Background Information on Formed Manure Storages (Form 9c, continued)

A **Formed Manure Storage** is a structure designed for storage purposes only. It is commonly constructed of concrete or glass-lined steel and used typically on dairy and swine operations. Sufficient volume should be provided to store all manure, urine, and process water for a six-month (minimum under NDEQ regulations) to a one-year period. No volume is included for treatment of manure and generally no volume is included for collecting open lot runoff.

Primary Volumes in a Manure Storage Basin

Freeboard. This is the level above which the liquid should not rise under any normal conditions. It sets the maximum liquid level for year round operation. NDEQ requires 0.5 foot depth for formed manure storage facilities.

Useable Storage Volume. A manure storage should provide sufficient volume to eliminate the need for winter application of manure and process water. The NDEQ minimum is a 180-day storage period. For existing facilities, this requirement can be waived if the producer can document the ability to manage a smaller sized storage. However, many systems are designed with greater volume than the minimum. For example, below barn pits are often sized to store manure for an entire year.

Unpumpable Liquids and Solids. Due to equipment limitations and solids accumulation, at least one foot of depth is generally considered unavailable for manure storage because it cannot be pumped. For pit storage below the barn floor, unpumpable liquids and solids can occupy a greater depth.

Staff Gauge Levels

Must Pump Level (required). The staff gauge (or other marker) must have a visible marking 1.5 feet below the lowest point in the concrete or steel wall. Storage level should never exceed this point.

Pre-Winter Must Pump Level (required). Prior to winter, the storage level must be dropped to a point that allows at least 180 days of storage before liquid level reaches the "Must Pump" marker.

Form 9d. LWCF* Inventory – Runoff Holding Pond

Additional information on runoff holding ponds found on pages 28 and 29.

Runoff Holding Pond Characteristics: Facility ID: _____

a. Animals Contributing to Facility	b. Depth to Ground Water	c. Distance to Surface Water	Storage Volume		f. Purpose of Facility: In addition to storage of runoff from _____ acres, this facility is used for:		
			d. Total Volume (cubic feet)	e. 25 yr – 24 hr Storage Volume	Storage of Process Water from:	Storage of Manure?	Manure Treatment?
Example: 1, 3, & 4	*50+ ft.*	*¼ mile*	*1,200,000 ft³*	*730,000 ft³.**	*animal housing cleaning & pull plug pit recharge*	☐ Yes ☐ No	☐ Yes ☐ No
						☐ Yes ☐ No	☐ Yes ☐ No

*For 40-acre open lot in region with 25-year, 24-hour storm event estimated to be 5 inches.

Summary of Typical Management:

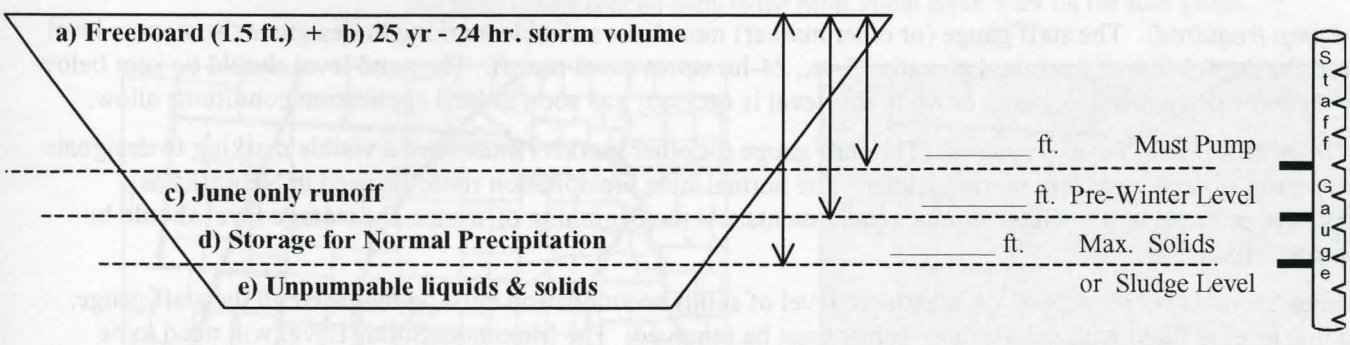
_____

_____

_____

_____

Storage Volumes & Critical Storage Levels :



*LWCF: Livestock Waste Control Facility

Background Information on Runoff Holding Pond (Form 9d, continued)

A **Runoff Holding Pond** is a structure designed for storage of storm water runoff from an open lot animal housing facility. It is commonly used on open lot beef and dairy operations. Design is based upon the size of an anticipated storm event and the runoff associated with this event. The pond is designed to store this runoff until an appropriate time for land application of the collected runoff.

Primary Volumes in a Manure Storage Basin

Freeboard. This is the level above which the liquid should not rise after a 25-year, 24-hour storm event. Freeboard plus storm water runoff sets the maximum level above which liquid level must not exceed under normal conditions. NDEQ requires 1.5 feet for earthen storage facilities.

Storm Water Runoff. For a runoff holding pond, the structure must hold all storm water runoff from a 25-year, 24-hour storm including runoff from the open lot, incidental drainage area, and the precipitation falling directly on the holding pond from this single storm event (NDEQ and EPA requirement).

Normal Precipitation Runoff. Open lot runoff holding ponds must store runoff from normal precipitation events. It is also recommended that this volume be sufficient to minimize the need for winter application. To provide sufficient storage, NDEQ requires a minimum acceptable volume for Normal Precipitation Runoff equal to the average runoff during the month of June. Many holding pond designs will include additional capacity. For systems spreading runoff water by irrigation, it is common to provide additional storage volume to allow water application only during the cropping season.

Unpumpable Liquids and Solids. Due to equipment limitations and solids accumulation, some volume cannot be emptied from the storage. For holding ponds with no settling basins prior to the pond, a volume for settled solids must be included in the design. If runoff passes through well-designed settling basins, only about one foot needs to be allowed for unpumpable liquids and solids.

Staff Gauge Levels

Must Pump (required). The staff gauge (or other marker) must have a visible marking to designate the storage level required for the 1.5 feet of freeboard plus the 25-yr., 24-hr. storm event runoff. The pond level should be kept below this level and when exceeded, pump down to this level is necessary as soon as land application conditions allow.

Pre-Winter Must Pump Level (required). The staff gauge (or other marker) must have a visible marking to designate the maximum storage level for entering winter. The normal June precipitation runoff is used in Nebraska as a conservative estimate of the winter storage requirements. At the beginning of winter, the storage level should be below this marker.

Maximum Solids Level (required). A maximum level of solids accumulation must be indicated on the staff gauge. When this level is filled with solids, those solids must be removed. The Maximum Solids Level will need to be identified from the original engineering drawings and calculations for sizing of the runoff holding pond.

Calculation of Must Pump Level

1. Area from which runoff is collected including all open lots, holding pond area and all additional contributing areas.
   RA = _____ acres

2. 25-year, 24-hour rainfall event from Figure 1.
   STORM = _____ inches

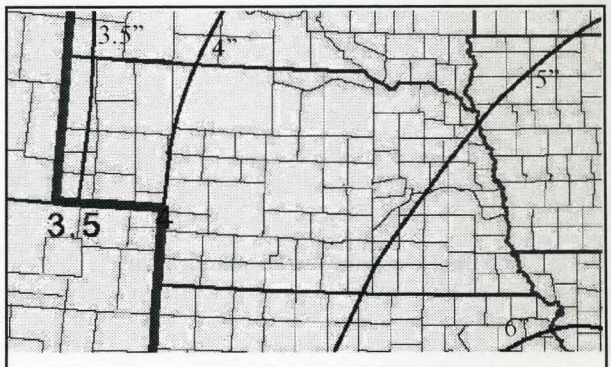


Figure 1. 25-year, 24-hour rainfall event for Nebraska

3. Estimated maximum runoff volume from 25-year, 24-hour rainfall event.

Runoff volume = 3630 X RA X STORM

= 3630 X _____ X_____

Runoff volume = _____ cubic feet OR Multiply by 7.5 for gallons: _____gallons

4. Must Pump Level (MPL) mark for staff gauge:

MPL = Freeboard + Depth to hold 25-yr., 24-hr. storm event

= 1.5' + Runoff volume / (Avg. pond width X Avg. pond length) [1]

= 1.5'. + _____ cubic feet / (_____ ft. X _____ ft.)

=_____ feet from lowest spot on berm to the Must Pump level mark on the staff gauge.

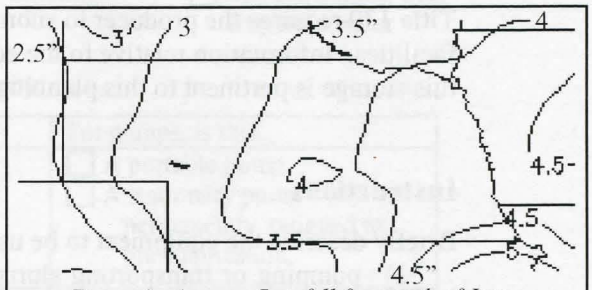


Figure 2. Average Rainfall for month of June

Calculation of Pre-Winter Must Pump Level.

1. Average June rainfall.

JUNE = _____ inches (Figure 2)

2. Percent runoff for June.

R_J = _____ % (Figure 3 or 4)

3. Estimated volume of runoff from average June rainfall.

June Runoff Volume = 3630 X RA X JUNE X R_J /100

= 3630 X _____ X _____ X _____

= _____ cubic feet OR Multiply by 7.5 for gallons: _____gallons

4. Pre-Winter Must Pump Level (MPL_{winter}) mark for staff gauge:

MPL_{winter} = MPL + Depth to hold June Runoff Volume

= MPL + June Runoff Volume / (Avg. pond width X Avg. pond length)[2]

= _____ ft. + _____ cubic feet / (_____ ft. X _____ ft.)

=_____ feet from lowest spot on berm to the Must Pump depth mark on the staff gauge.

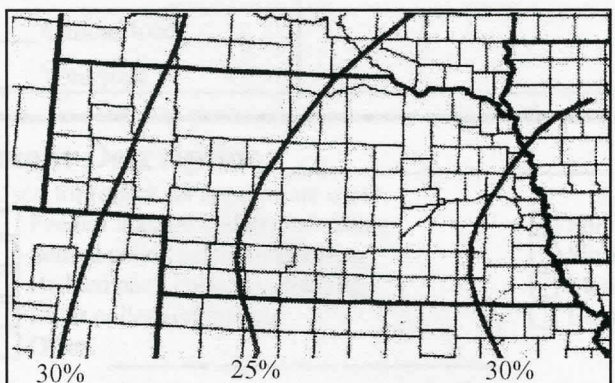


Figure 3. June Runoff from Dirt Lots as % of Mean Monthly Precipitation

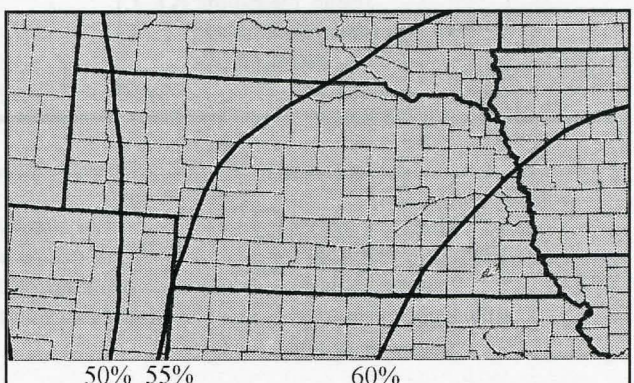


Figure 4. June Runoff from Concrete Lots as % of Mean Monthly Precipitation

[1] Average pond width and length (assuming rectangular pond) should be estimated at a depth halfway between the Must Pump level and lowest point on berm. If pond is not rectangular, replace width and length with estimated pond area (ft^2).

[2] Average pond width and length (assuming rectangular pond) should be estimated at a depth halfway between the Pre-Winter level and Must Pump levels. If pond is not rectangular, replace width and length with estimated pond area (ft^2).

Instructions for Manure, Sludge or Effluent Handling Equipment Inventory (Form 10)

Purpose

Identify equipment to be used in the operation of the manure storage facility.

NDEQ Title 130

Title 130 requires the producer to submit an Operation and Maintenance Plan for the manure storage facilities. Information relative to the equipment used in the management of the manure or wastewater in this storage is pertinent to this planning requirement.

Instructions

Briefly describe the equipment to be used for:

1) pumping or transporting slurry or liquid manure from animal housing to settling basin, anaerobic lagoons, holding ponds or manure storage;
2) pumping or transporting slurry or liquid manure from settling basin, anaerobic lagoons, holding ponds or manure storage to a land application site;
3) agitation of manure or settled solids within a storage facility; and
4) collection of manure in an open lot (box scraper, front end loader, etc.).

Equipment used for land application of manure should be identified and described in detail on *Form 5* in the *Manure Application CNMP Workbook.*

Form 10. Manure, Sludge or Effluent Handling Equipment Inventory

Equipment Description: _____

Used for (check all appropriate uses):

- ☐ Feedlot manure collection/loading
- ☐ Settled solids collection/loading
- ☐ Bedded pack collection/loading
- ☐ Litter collection/loading
- ☐ Other: _____
- ☐ Solid manure transport
- ☐ Slurry/liquid transport
- ☐ Manure storage agitation
- ☐ Barn floor or alley cleaning
- ☐ Slurry pumping
- ☐ Topwater pumping
- ☐ Sludge removal
- ☐ Manure mixing with irrigation water

For pumping and transport equipment, define pumping or handling capacity:

Pumping or handing capacity	Describe power source and size (hp)	For pumps, is this:
_____ GPM _____Gallons/load _____Tons/load		☐ A portable pump. ☐ A stationary pump permanently assigned to one application.

Equipment Description: _____

Used for (check all appropriate uses):

- ☐ Feedlot manure collection/loading
- ☐ Settled solids collection/loading
- ☐ Bedded pack collection/loading
- ☐ Litter collection/loading
- ☐ Other: _____
- ☐ Solid manure transport
- ☐ Slurry/Liquid transport
- ☐ Manure storage agitation
- ☐ Barn floor or alley cleaning
- ☐ Slurry pumping
- ☐ Top water pumping
- ☐ Sludge removal
- ☐ Manure mixing with irrigation water

For pumping and transport equipment, define pumping or handling capacity:

Pumping or handing capacity	Describe power source and size (hp)	For pumps, is this:
_____ GPM _____Gallons/load _____Tons/load		☐ A portable pump. ☐ A stationary pump permanently assigned to one application.

Equipment Description: _____

Used for (check all appropriate uses):

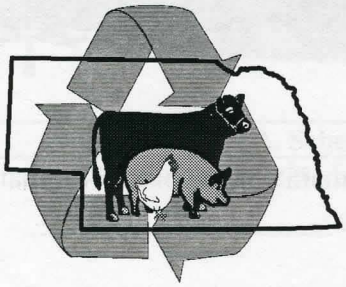
- ☐ Feedlot manure collection/loading
- ☐ Settled solids collection/loading
- ☐ Bedded pack collection/loading
- ☐ Litter collection/loading
- ☐ Other: _____
- ☐ Solid manure transport
- ☐ Slurry/Liquid transport
- ☐ Manure storage agitation
- ☐ Barn floor or alley cleaning
- ☐ Slurry pumping
- ☐ Top water pumping
- ☐ Sludge removal
- ☐ Manure mixing with irrigation water

For pumping and transport equipment, define pumping or handling capacity:

Pumping or handing capacity	Describe power source and size (hp)	For pumps, is this:
_____ GPM _____Gallons/load _____Tons/load		☐ A portable pump. ☐ A stationary pump permanently assigned to one application.

Nebraska's CNMP

Strategic Plan



Inventory

Strategic Plan

Operation and Maintenance Plan	34
Sludge Management Plan	38
Closure Plan for Earthen Storages	42
Emergency Response Plan	46

Review as Necessary

NDEQ Permit Application

Annual Plan
(No Relevant Forms)

Annual Review

NDEQ Permit Maintenance

Review and Plan Modification
(No Relevant Forms)

Sample Records

Instructions for Operational and Maintenance Plan for Manure or Runoff Storage (Form 11)

Purpose

This worksheet identifies issues to be addressed in the operation and maintenance plan for a manure storage facility.

NDEQ Title 130

Title 130 states "The application shall include a operational and maintenance plan, which includes a schedule for monitoring of available waste storage capacity, a schedule for comprehensive inspections of the facility, methods to prevent tampering with gravity drain valves, waste removal based on type and capacity of the facility and the availability of disposal area, maintenance activities, procedures to maintain the facility for periods of time when it is not in operation, and record keeping of all maintenance or necessary repairs made to the facility or appurtenances as required in Chapter 11 of these regulations."

Instructions

Describe anticipated procedures, types of equipment, and any appropriate measurements that are to be used for each of the following five topics:

1. Schedule of livestock manure storage facility inspection.
2. Monitoring of available storage capacity.
3. Land application and manure removal.
4. Planned maintenance activities.
5. Record keeping.

Additional Information

- Lesson 24, Operation and Maintenance of Manure Storage Facilities, Livestock and Poultry Environmental Stewardship curriculum available online at http://www.LPES.org/les_plans.html.
- NDEQ Guidance Documents for Operation and Maintenance Plan Outline (see page 62).

Form 11. Operational and Maintenance Plan for Manure or Runoff Storage

Part A. Schedule of Livestock Manure Control Facility Inspections

1) Frequency of visual checks of storage facilities:

_____ for storage level. _____ for structural integrity, maintenance, and safety issues.

2) Specific issues to be addressed by visual inspection (check appropriate responses). See *Form 16* for sample Manure Storage Inspection Form.

- ☐ Level
- ☐ Liner erosion
- ☐ Animal water supply
- ☐ Structural integrity
- ☐ Clean water diversion
- ☐ Safety (not mandatory)
- ☐ Pumping equipment/valves
- ☐ Odor (not mandatory) Other: _____
- ☐ Security equipment Other: _____

3) Security measures to prevent tampering of valves or pumping equipment (Security measures are required on gravity or siphon drains):

Part B. Monitoring Available Storage Capacity.

1) Depth from top of storage (lowest point) to critical storage levels. Estimate storage capacity and required pond depth for storing this quantity (see *Forms 9a* through *9d*):

	Storage Volume		Depth Required to Store This Volume	
a. Freeboard (0.5 ft for formed storages and 1.5 feet for earthen storages)	_____	ft^3	_____	ft.
b. Runoff from 25-yr, 24 hr. storm event (open lots only)	_____	ft^3	_____	ft.
c. Runoff from normal June precipitation (open lots only)	_____	ft^3	_____	ft.
d. 180 day manure and process water volume (confinement barns with slurry or liquid manure system only)	_____	ft^3	_____	ft.
Total depth required for Pre-Winter Must Pump Level[1]			_____	ft.
Must Pump level for rest of year[2]			_____	ft.
Stop pumping level for anaerobic lagoon (see *Form 9a)*			_____	ft.

2) Method (or Depth Gauge) for measuring depth or remaining capacity:

[1]For anaerobic lagoons, manure storage basins, or formed manure storages (concrete or steel tanks), sum lines a and d. For runoff holding ponds, sum a, b, and c.

[2]For anaerobic lagoons, manure storage basins, and formed manure storages concrete and steel tanks), freeboard (line a) is Must Pump Level, for runoff holding ponds, sum lines a and b.

Form 11. Operational and Maintenance Plan for Manure or Runoff Storage (continued)

Part C. Land Application or Manure Removal

1) Equipment. Available equipment for is summarized in *Manure/Effluent Handing Equipment Inventory (Form 10)* and *Land Application Equipment Inventory* (*Form 5* in *Manure Application Workbook*).

2) Timeline for manure removal and land application activities that are applicable. Identify with an "R" for manure removal and "A" for manure application.

Month	J	F	M	A	M	J	J	A	S	O	N	D
• Manure removal from open lot or barn	—	—	—	—	—	—	—	—	—	—	—	—
• Liquid removal from holding pond or lagoon	—	—	—	—	—	—	—	—	—	—	—	—
• Manure removal from storage facility	—	—	—	—	—	—	—	—	—	—	—	—
• Solids removal from setting or debris basin	—	—	—	—	—	—	—	—	—	—	—	—

Part D. Planned Maintenance Activities*

1) Open Lots Drainage or Waterway Maintenance, Settled Solids Removal:

2) Clean Water Diversions, Berms, Ditches, and Culverts:

3) Animal Water Supply:

*Include frequency of planned maintenance where applicable.

Form 11. Operational and Maintenance Plan for Manure or Runoff Storage (continued)

Part D. Planned Maintenance Activities (continued)
(include frequency of planned maintenance where applicable)

4) Earthen Construction (berms and dams):

5) Liners for Seepage Control (earthen and membrane liners):

6) Concrete Construction:

7) Manure Piping/Plumbing/Pumps:

8) Other:

Part E. Record Keeping

Check records to be kept and, where appropriate, list record form name or number (attach sample forms).

- ☐ Manure Land Application Records[1]: _____
- ☐ Repair Records: _____
- ☐ Inspection Records: _____
- ☐ Storage Level Records: _____
- ☐ Rainfall Records:
- ☐ Other:

[1]See *Manure Application Workbook, Forms 21-24.*

Instructions for Sludge and Sediment Management Plan (Form 12)

Purpose

This worksheet identifies issues to be addressed in the planning requirements for managing sludge that accumulates in an anaerobic lagoon, runoff holding pond, or settling basin.

NDEQ Title 130

Title 130 states "The application shall include a sludge management plan for holding ponds and lagoons, which includes periodic monitoring of accumulated solids and a schedule for removal. In the case of liquid storage pits, adequate storage shall be provided prior to winter operation. Methods to provide this storage shall be described in the operational and maintenance plan."

Instructions

Describe anticipated procedures, types of equipment, and any appropriate measurements that are to be used to address six principles of sludge management. Select only those topics that are applicable to your situation:

1. Minimization of sludge accumulation.
2. Monitoring of sludge accumulation.
3. Trigger point at which sludge will be removed.
4. Equipment and procedures for sludge removal and handling.
5. Procedures to be implemented for protection of storage liner during removal of accumulated sludge or solids.
6. Procedures to be implemented for agronomic application of sludge.
7. Procedures for limiting odor production from land application of the sludge.

Additional Information

- NDEQ Guidance Documents for Sludge Management Plan (see page 64)
- *Sludge Management for Anaerobic Lagoon and Runoff Holding Ponds,* NebGuide G98-1371. Available from your county Cooperative Extension office or online at http://www.ianr.unl.edu/pubs/wastemgt/g1371.htm.
- Lesson 44, Emission Control Strategies for Land Application, Livestock and Poultry Environmental Stewardship curriculum available online at http://www.LPES.org/les_plans.html.

Form 12. Sludge and Sediment Management Plan

Describe anticipated procedures, types of equipment, and any appropriate measurements that are to be used for sludge management in holding ponds and lagoons, using each of the following principles.

Sludge Management Plan Principle	Individual Producer's Plan: Describe actual procedures, types of equipment, appropriate measurements, and other procedures specific to individual plan.	Timeline or Frequency
1. Identify practices that minimize sludge accumulation. (e.g. solids removal, annual pumping of sludge)		
2. Describe procedure and frequency for monitoring the sludge accumulation		
3. Identify the sludge depth at which time sludge accumulation is to be pumped down or removed (Form 6)		
4. Identify equipment (see Form 7 *for equipment information) and procedures for sludge handling.*	Sludge Removal (Pumping, Agitation, Drag Line, etc.)	
	Manure Application (Transporting and Distribution on Soil)	

Form 12. Sludge and Sediment Management Plan (continued)

Sludge Management Plan Principle	Individual Producer's Plan: Describe actual procedures, types of equipment, appropriate measurements, and other procedures specific to individual plan.	Timeline or Frequency
5. Describe procedures to be implemented for protection of the integrity of the earthen liner.		
6. *Describe procedures to be implemented for determining agronomic application rates.* (e.g. Form 17, 18, and 19 of Manure Application Workbook)	Sludge Analysis (N & P Minimum) Application Rate Determination	
7. Describe procedures for limiting odor production from land application of the sludge. (Form 3 of Odor Management Workbook)		

Instructions for Closure Plan For Earthen Storages (Form 13)

Purpose

This worksheet identifies a six-step planning process for a closure plan for earthen manure storages, lagoons, and holding ponds.

NDEQ Title 130

A closure plan is required for all manure storage facilities permitted by NDEQ. Title 130 states "The application shall include a plan to close the facility, to be implemented within 12 months of discontinuation of the livestock operation. The plan should detail the disposition of all accumulated waste, which complies with the requirements of Chapter 11 of these regulations."

Instructions

1. Identify the procedures and approximate timing to be implemented for Steps 1, 2, and 3 that relate to the removal and land application of any manure, effluent, or pumpable sludge.
2. Select from two options for completing the closure process. Option A eliminates the storage structure and returns the area to its previous form. Option B converts the storage into a farm pond.
3. Depending on the option selected, identify the procedures and approximate timing for Steps 4, 5, and 6.

Additional Information

- NebGuide G98-1370, *Abandonment Planning for Earthen Manure Storages, Holding Ponds, and Anaerobic Lagoons.* This publication is available from your county Cooperative Extension Office or online at **http://www.ianr.unl.edu/pubs/wastemgt/g1370.htm**.
- NDEQ Environment Guidance Document for Closure Plans (see page 66).

Form 13. Closure Plan For Earthen Storages

Abandonment Plan Principle	Individual Producer's Plan: Describe actual procedures, types of equipment, appropriate measurements, and other activities specific to individual plan.	Time Line for Completion*
Step 1. Removal of liquids and pumpable slurry.		
Step 2. Protection of the integrity of the existing earthen liner.		
Step 3. Land application of the liquid and pumpable slurry at agronomic rates (Manure analysis, method for estimating application rates).		

Form 13. Closure Plan For Earthen Storages (continued)

To complete the closure process, two options are available. Identify the option that will be applied in this situation:
☐ Option A. Elimination of earthen storage structure. ☐ Option B. Establishment of a farm pond.

Abandonment Plan Principle	Individual Producer's Plan: Describe actual procedures, types of equipment, appropriate measurements, and other activities specific to individual plan.	Time Line for Completion*
Option A: *Step 4. Divert all surface water runoff away from the storage.* *Option B:* *Step 4. Set maximum water level.*		
Option A: *Step 5. Fill the lagoon with soil.* *Option B:* *Step 5. Rinse the lagoon with fresh water.*		
Option A: *Step 6. Establish a growing crop or sod.* *Option B:* *Step 6. Refill lagoon with water.*		

*NDEQ requires notification of implementation and completion of closure plan.

Instructions for Emergency Response Plan (Form 14)

Purpose

The Emergency Response Plan is designed to identify the specific steps to be taken to limit the impact of a manure or effluent spill and to convey those steps to all farm managers and employees.

NDEQ Title 130

Title 130 states "The application shall include an emergency response plan for any spill, release or discharge of animal waste due to such events as power failures, large storms or chronic wet periods, leaks or breaks in water supply systems, component failure of the waste control facilities and any releases during land application due to equipment failure or accidents or irrigation equipment failure. Any discharge of waste shall be reported to the Department within 24 hours of the event and in a written report to the Department within seven (7) days of the event. For any discharge, the Department may request the operation to supply rainfall, land application and system storage records for up to the previous 12-month period prior to the discharge event."

Instructions

Step 1. Identify situations that might result in a manure spill on your livestock operation such as a slury tank overturn or break in a berm of an earthen storage.

Step 2. Identify the specific first response steps to be taken to contain the spill, the farm's emergency response leader to whom the spill is to be reported, the available equipment for containing or cleaning up the spill and where it can be obtained, additional contacts to be made by the farm's emergency response leader, and any additional steps for correction or restoration of any problems.

Step3. Repeat this procedure for each potential manure discharge.

Additional Information

- NDEQ Guidance Documents for Emergency Response Plan Outline (see page 67)
- LPES Lesson 50. Emergency Action Plans
  LPES – Livestock and Poultry Environmental Stewardship curriculum. This educational product for livestock producers and advisors can be viewed online at **http://www.LPES.org/les_plans.html** or ordered from MWPS at (800) 562-3618. This educational program was jointly produced and field tested by representatives of 15 land grant universities, USDA Agricultural Research Service, and USDA Natural Resources Conservation Service.

Form 14. Emergency Response Plan

Farm Name and Location: _____ **Date:** _____

Potential Cause of Discharge (situations for which NDEQ requires Emergency Response Plan are listed below):

☐ Power Failure ☐ Storm/Extended Wet Period ☐ Accident

☐ Equipment Failure: Describe: _____

☐ Failure of Berm or Other Facility Component: _____

☐ Other: _____

In Case of an Emergency:

1. *Implement the following first response or containment steps:*

2. *Assess the extent of the emergency and determine how much help is needed.*

3. *Contact the farm's emergency response team leader:*

Name: _____ Phone: _____

Name: _____ Phone: _____

4. *Give the team leader the following information:*
   - Your name
   - Farm identification
   - Description of emergency
   - Estimate of the amounts, area covered, and distance traveled.
   - Has manure reached surface waters or major field drains?
   - Is there any obvious damage: employee injury, fish kill, or property damage?
   - What is currently in progress to contain situation?

5. *Available equipment/supplies for responding to emergency:*

Equipment/Supplies	Contact Person	Phone Number

6. *Contacts to be made by farm's emergency response leader (discharge must be reported to NDEQ within 24 hrs.):*

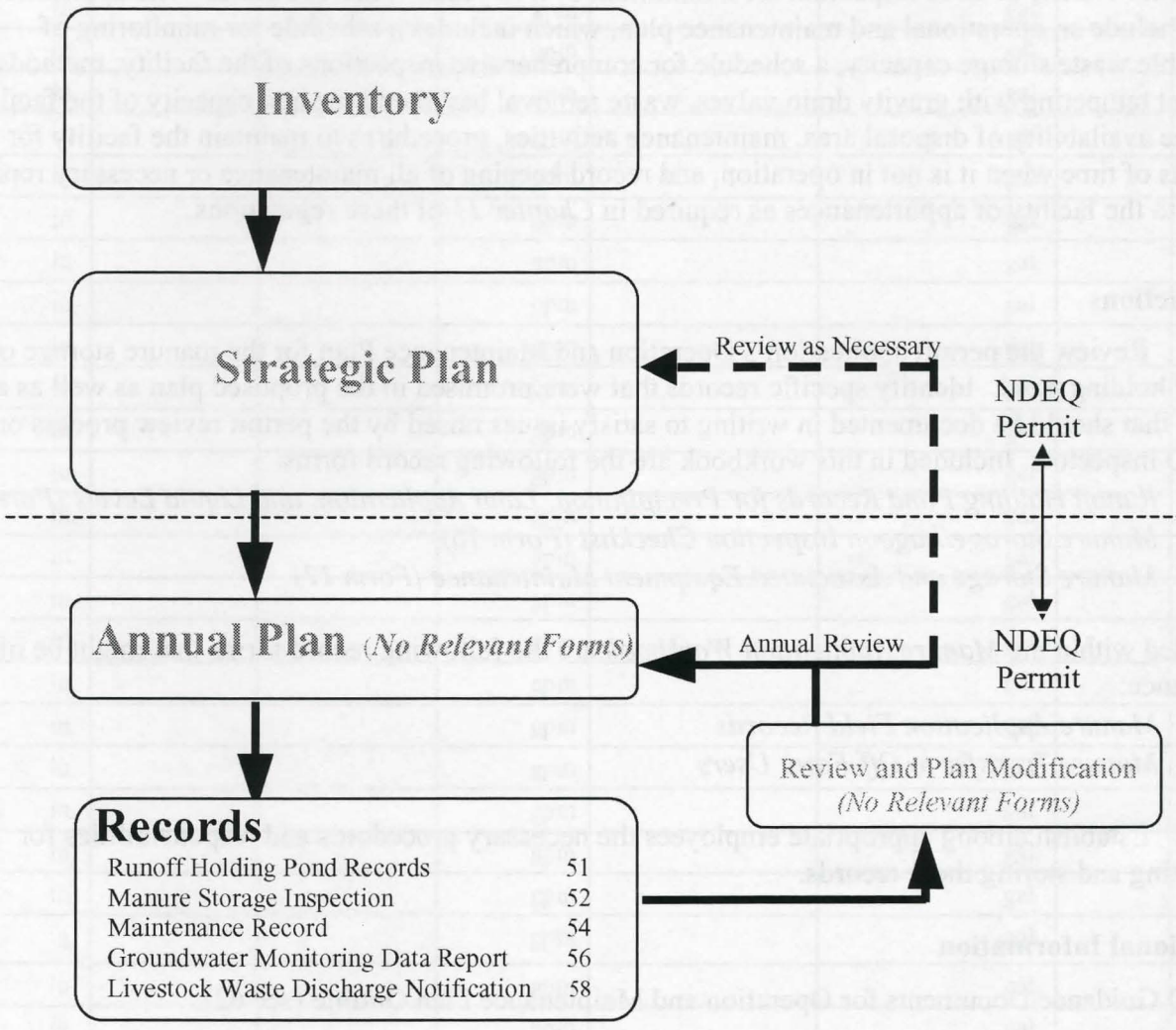
Organization	Contact Person	Phone Number
NDEQ – Agricultural Division		(402) 471-2186

7. *Additional containment measures, corrective measures, or property restoration measures.*

8. Written reports must be filed with NDEQ within 7 days for manure or wastewater discharge.

Nebraska's CNMP

Sample Records



Instructions for Records for Implementing Manure Storage Operation and Maintenance Plan (Forms 15, 16, and 17)

Purpose

Records are required for documenting satisfactory implementation of the *Operation and Maintenance Plan for the Manure Storage or Runoff Holding Pond (Form 11).* Three possible record forms are provided for addressing record keeping requirements.

NDEQ Title 130

Records to document the implementation of the Operation and Maintenance Plan should be maintained on file for NDEQ or EPA inspection for a minimum of five years. Title 130 states "The application shall include an operational and maintenance plan, which includes a schedule for monitoring of available waste storage capacity, a schedule for comprehensive inspections of the facility, methods to prevent tampering with gravity drain valves, waste removal based on type and capacity of the facility and the availability of disposal area, maintenance activities, procedures to maintain the facility for periods of time when it is not in operation, and record keeping of all maintenance or necessary repairs made to the facility or appurtenances as required in *Chapter 11* of these regulations."

Instructions

Step 1. Review the permit application's Operation and Maintenance Plan for the manure storage or runoff holding pond. Identify specific records that were promised in the proposed plan as well as any issues that should be documented in writing to satisfy issues raised by the permit review process or NDEQ inspectors. Included in this workbook are the following record forms:

- *Runoff Holding Pond Records for Precipitation, Land Application, and Liquid Levels (Form 15).*
- *Manure Storage/Lagoon Inspection Checklist (Form 16).*
- *Manure Storage and Associated Equipment Maintenance (Form 17)*

Included within the *Manure Application Workbook* are the following record forms that might be of assistance:

- *Manure Application Field Records*
- *Manure Transfer to Off-Farm Users*

Step 2. Establish among appropriate employees the necessary procedures and responsibilities for collecting and storing these records.

Additional Information

NDEQ Guidance Documents for Operation and Maintenance Plan Outline (see 62).

Form 15. Runoff Holding Pond Records for Precipitation, Land Application, and Liquid Levels

Purpose: A record of precipitation, land application events, and liquid levels is required for all NDEQ and U.S. EPA permitted holding ponds for containing storm related runoff from open lot production systems.

Month and Year:_____ **Holding Pond ID:**_____

Day	Precipitation	Land Application or Discharge to Waters of the State						Pond Liquid Level [2]
		Hour/Minute Pumping Started	Hour/Minute Pumping Stopped	Pump Flow Rate (gpm)	Location or Field Used for Application	Total Volume Pumped	Check If Discharge[1]	
1	in.			gpm		gal.		ft.
2	in.			gpm		gal.		ft.
3	in.			gpm		gal.		ft.
4	in.			gpm		gal.		ft.
5	in.			gpm		gal.		ft.
6	in.			gpm		gal.		ft.
7	in.			gpm		gal.		ft.
8	in.			gpm		gal.		ft.
9	in.			gpm		gal.		ft.
10	in.			gpm		gal.		ft.
11	in.			gpm		gal.		ft.
12	in.			gpm		gal.		ft.
13	in.			gpm		gal.		ft.
14	in.			gpm		gal.		ft.
15	in.			gpm		gal.		ft.
16	in.			gpm		gal.		ft.
17	in.			gpm		gal.		ft.
18	in.			gpm		gal.		ft.
19	in.			gpm		gal.		ft.
20	in.			gpm		gal.		ft.
21	in.			gpm		gal.		ft.
22	in.			gpm		gal.		ft.
23	in.			gpm		gal.		ft.
24	in.			gpm		gal.		ft.
25	in.			gpm		gal.		ft.
26	in.			gpm		gal.		ft.
27	in.			gpm		gal.		ft.
28	in.			gpm		gal.		ft.
29	in.			gpm		gal.		ft.
30	in.			gpm		gal.		ft.
31	in.			gpm		gal.		ft.

1 This column should be checked if pump out is directed to surface waters, wetlands, ditch or drainage connecting to surface waters. NDEQ should be notified by phone within 24 hours. Review and follow NDEQ reporting requirements.

2. Liquid level is measured from: ___Low point at top of berm, dam, or spillway; ___Bottom of storage; ___Must Pump Level mark on liquid level indicator.

Measure to the nearest one foot.

Form 16. Manure Storage/Lagoon Inspection Checklist (Part 1)

Checks in shaded boxes suggests potential problem or risk.

Farm:_____ Pit/Storage/Lagoon ID:_____ Year:_____

Date								
Inspected by (initials):								

Manure/Effluent Level Observations

Depth remaining to sidewall low point (ft.) [1]																	Comments
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Is liquid level marker available & visible?																	
Does sufficient freeboard exist? [2]																	
Manure pump/transfer pipes functioning?																	
Recycle pumps/transfer pipes functioning?																	

Security

Are gravity drains or pump power supplies locked/secure from tampering?																	

Earthen Storage Structure

Interior Liner Erosion Observed:	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Due to wave action?																	
In vicinity of inlets?																	
In vicinity of outlets?																	
Due to erosion from rainfall?																	
Near agitation equipment access points?																	
Signs of berm/dam damage due to:																	
Burrowing animals?																	
Presence of trees?																	
Presence of large weeds?																	
Erosion or gullies?																	
Poorly established sod?																	
Are there indications of:																	
Damp, soft, or slumping areas on berms?																	
Seepage near toe of berm?																	
Seepage around pipes through the berm?																	

1. Measured from liquid surface to lowest point on top of dam, berm or spillway (nearest one foot interval).
2. Concrete or steel storage structure…6"; Earthen storage basin or lagoon…18"; Runoff holding pond…18" + sufficient volume for runoff from 25-yr. 24-hr. storm

Form 16. Manure Storage/Lagoon Inspection Checklist (part 2)

Checks in shaded boxes suggests potential problem or risk.

Farm:_____ Pit/Storage Lagoon ID:_____ Year: _____

Date																	Comments
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Concrete/Steel Tanks																	
Signs of cracks or structural damage?																	
Signs of leakage or overflow?																	
Signs of wet spots around base of tank?																	
Clean Water Diversion																	
Are perimeter drains plugged or blocked?																	
Is roof water entering storage?																	
Is field runoff entering storage?																	
Are diversions/waterways maintained?																	
Visual Appearance and Safety																	
Is site neat and recently mowed?																	
Is storage visually hidden from public?																	
Are mortality or afterbirth observed?																	
Are medical consumables observed?																	
Is area fenced and properly marked?																	
Is escape ladder available?																	
Anaerobic Lagoon: ***Odor***																	
Is lagoon purple?																	
Is lagoon at least 1/3 full?[1]																	
Is lagoon actively bubbling?																	
Electrical conductivity (mmho/cm)?																	
Manure storage or holding pond:																	
Is structure covered or crusted over?																	
All structures:																	
Are all inlet pipes submerged?																	
Rate down-wind odor from facility?[2]																	

[1] OR above permanent pool level mark on staff gauge.

[2] Down-wind odor from manure storage: 1…None; 2… Faint; 3…Distinct; 4…Strong; 5…Unbearable

Form 17. Manure Storage and Associated Equipment Maintenance Record

Date	Storage or Equipment	Maintenance Performed	Worker Initials

Instructions for Livestock Groundwater Monitoring Data Report (Form 18)

Purpose

This section is for reporting to NDEQ results of water analysis from groundwater monitoring of wells installed in the vicinity of the manure storage, anaerobic lagoon, or runoff holding pond. Copies of reports should be maintained with other environmental records.

NDEQ Title 130

Based on a livestock facility's permit application and the geological characteristics below the livestock facility, NDEQ may require groundwater monitoring in the vicinity of the manure storage. As part of the permit requirements, selected livestock facilities with high risk manure storage sites are required to install three or more monitoring wells. Water samples must be taken twice a year (spring and fall), analyzed for nitrate, chloride, and ammonia, and reported to NDEQ. Samples can be collected only by the property owner or an individual certified and licensed by the Nebraska Health and Human Services – Regulation and Licensure division.

Instructions

1. Twice a year, spring and fall, collect samples from all monitoring wells. See NDEQ document (referenced below) for specifics of sampling procedures.
2. Complete sample reports provide them to NDEQ within 45 days of the sampling event.
3. A form for reporting results to NDEQ follows *(Form 18)*.

Additional Information

NDEQ Environmental Guidance Document, *"Guideline for Groundwater Monitoring Plans at Livestock Waste Control Facilities,"* pages 68. The report form on the next page is from this NDEQ Guidance Document.

This page may serve as a notebook divider behind which current and past groundwater monitoring reports can be stored.

Form 18. Livestock Groundwater Monitoring Data Report

Livestock Operation Name: _____

Address: _____

Name of Individual Collecting Samples: _____

Organization: _____

Certified Water Well Monitoring Supervisor Certificate #: _____

Name of Lab Performing Analysis: _____

City/State _____

Sample Date: _____

Sample Analysis Results:

Sample or Well ID	DNR Registration Number	Depth to Water (feet from top of casing prior to sampling)	Nitrate-N (mg/l or ppm)	Ammonia-N (mg/l or ppm)	Chloride (mg/l or ppm)
Blank*					

Blank might be a distilled water sample such as is sold for ironing clothes.

Laboratory Method Used for Sample Analysis. This information should appear on the lab report or can be obtained by calling the lab performing the water analysis.

Chemical Analyzed	EPA Lab Method Number	Method Detection Limit (MDL)	Reporting Limit (RL)
Nitrate-N			
Ammonia-N			
Chloride			

Notes: _____

_____

_____

Mail Results to:

NDEQ - Agriculture Section, 1200 N Street, Suite 400, P.O. Box 98922, Lincoln, NE 68509

Instructions for Livestock Waste Discharge Notification (Form 19)

Purpose

The following form is recommended by NDEQ for use in reporting any discharge, both planned and accidental, from a livestock waste control facility.

NDEQ Title 130

According to Title 130, "Discharge" shall mean the accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of pollutants into any waters of the State or in a place which will likely reach waters of the State."

Title 130 requires "Any discharge of waste shall be reported to the Department within 24 hours of the event and in a written report to the Department within seven (7) days of the event. For any discharge, the Department may request the operation to supply rainfall, land application and system storage records for up to the previous 12-month period prior to the discharge event."

"A discharge of livestock waste from a Livestock Waste Control Facility (LWCF) is prohibited unless:

1. Such discharge is to prevent a facility failure, which would result in loss of life, personal injury or severe property damage;
2. No feasible alternative exists;
3. The permittee submits a notice to the Director of the Nebraska Department of Environmental Quality (NDEQ) within 24 hours of becoming aware of a discharge or the need to discharge[1]; and
4. The discharge is conducted under such conditions as to minimize any adverse effects."

"The burden is on the permittee to demonstrate compliance with the above. Any discharge due to an improperly maintained or operated facility shall be subject to enforcement action..."

Instructions

Step 1. If a discharge occurs, initiate the steps identified in your Emergency Response Plan.
Step 2: Within 24 hours, notify NDEQ of the discharge.
Step 3. Complete the following form and deliver to NDEQ at the address listed below within seven days of the discharge.
Step 4: If you observe dead fish that could have resulted from the discharge, contact the Nebraska Game and Parks Commission **immediately** at (402) 471-0641. After hours, call (402) 471-4545.

Additional Information

Questions? Contact: Nebraska Department of Environmental Quality, Agriculture Section, P.O. Box 98922, Lincoln, NE 68509-8922; phone (402) 471-4239. Visit the web site at http://www.deq.state.ne.us.

Reference: The attached form and most of the information on this page is from NDEQ Environmental Guidance Document, *Livestock Waste Discharge Notification,* dated April 2000.

[1]Contact NDEQ at (402) 471-4239 or for operations located in the west half of Nebraska, contact the NDEQ North Platte Office at (308) 535-8142.

Form 19: Livestock Waste Discharge Notification

Name: _____
Permitted Operation Name

Owner/Manager: _____

Address: _____
P.O. Box, Street Address

_____
City, State and Zip Code

Legal Description of Operation

_____, of _____, _____ N, _____ □ E or □ W, _____ County
1/4 1/4 Section Township Range

Do you have an **NPDES** Permit? _____ Yes _____ No **If** yes, Permit No. _____

Complete the following:

1 List reason(s) for discharge (i.e., power failure, large storm or chronic wet period, leak or break in water supply system, component failure of the waste control facility; and/or releases during land application due to equipment failure, accidents or irrigation equipment failure):

_____

_____

2. The discharge flowed into _____
(ditch, drainage way, stream name)

3. Did the discharge flow directly into surface water or did the discharge flow over cropland prior to discharging to surface water? _____

4. The approximate width and depth of the surface water (which the discharge entered):
_____ (width in feet) and _____ (depth in feet)

5. The discharge started on (date and time): Please indicate if this was the actual time or if this was when the discharge was discovered.

_____

_____

6. The discharge ended on (date and time): Please indicate if this was the actual or the estimated time

_____

_____

(continued on next page)

7. Average flow of the discharge was: _____(gallons/minute)

8. Estimated total volume of discharge (cu.-ft.): _____(L x W x D)

9. List any damage to the waste control facility: _____

_____

_____

10. Describe factors and conditions that were used to minimize the adverse effects to the environment from the discharge: _____

_____

_____

OPTIONAL INFORMATION

1. You may submit rainfall, land application and system storage records for up to a 12- month period prior to the discharge event to demonstrate the need for the discharge.

2. If you choose to sample, the following items should be analyzed. Sample locations, at a minimum, must include point of discharge, upstream, downstream and the mix zone (where the discharge mixes with surface water). Provide a map with collection sites marked.

   a) Five-day Biochemical Oxygen Demand (BOD-S);
   b) total ammonium-nitrogen;
   c) nitrate-nitrite nitrogen;
   d) pH;
   e) temperature of the effluent and receiving stream;
   f) sodium;
   g) total phosphorus;
   g) chlorides;
   h) Chemical Oxygen Demand (COD);
   i) total kjeldahl nirogen;
   j) dissolved oxygen (field measurement).

3. Was sample kept cool with ice during time between sample was taken and delivery to lab?
   _____Yes _____No

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREIN IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

X _____

Signature of Authorized Representative Date

References

Manure Storages. MWPS-18, Section 2. Can be ordered from MWPS by calling 1-800-562-3618.

Livestock and Poultry Environmental Stewardship curriculum
- Lesson 20. Planning and Evaluation of a Manure Storage
- Lesson 21. Sizing Manure Storage, Typical Nutrient Characteristics
- Lesson 22. Open Lot Runoff Management Options
- Lesson 23. Manure Storage Construction and Safety, New Facility Considerations
- Lesson 24. Operation and Maintenance of Manure Storage Facilities
- Lesson 25. Manure Treatment Options
- Lesson 50. Emergency Action Plans

Available online at http://www.LPES.org or entire curriculum can be ordered from MWPS at 1-800-562-3618 ($25 for CD copy or $55 for printed copy). This educational program was jointly produced and field tested by representatives of 15 land grant universities, USDA Agricultural Research Service, and USDA Natural Resources Conservation Service.

University of Nebraska Nebguides
- *Abandonment Planning for Earthen Manure Storages, Holding Ponds and Anaerobic Lagoons,* G98-1370, available online at http://www.ianr.unl.edu/pubs/wastemgt/g1370.htm.
- *Feedlot Abandonment Recommended Procedures,* G96-1293, available online at http://www.ianr.unl.edu/pubs/beef/g1293.htm.
- *Sludge Management for Anaerobic Lagoons and Runoff Holding Ponds,* G98-1371, available online at http://www.ianr.unl.edu/pubs/wastemgt/g1371.htm.

Agricultural Waste Management Field Handbook, published by USDA Natural Resources Conservation Service. Accessible online at http://www.ftw.nrcs.usda.gov/awmfh.html.

Nebraska Department
of Environmental Quality

ENVIRONMENTAL FACT SHEET

00-032 March, 2000

Operational and Maintenance Plan Outline

I. Schedule of LWCF Component Inspections
   A. Open Lots
      1. Holding pond
      2. Debris basins, solid settling structures
      3. Risers, screens or slotted dams
      4. Ditches, berms, diversions, and culverts
   B. Confined or Housed Livestock Operations
      1. Lagoon or liquid waste storage facilities
      2. Solid separating equipment or structures
      3. Under floor collection or storage structures
      4. Mechanical scrapers
      5. Flush system
   C. Pumping or Waste Handling Equipment
   D. Security Measures on Valves and Other Mechanical Components (Security Measures Required on Gravity or Siphon Drains)

II. Monitoring of Available Storage Capacity
   A. Schedule of Monitoring Open Lot
   B. Schedule of Monitoring Confined
   C. Depth Markers or Method to Measure Remaining Capacity

III. Land Application or Waste Removal (Equipment and Timeline)
   A. Open Lots
      1. Holding ponds
         a. with solid settling system (debris basins)
         b. without solid settling system
      2. Debris basins
   B. Confined
      1. Lagoons
         a. earthen lined
         b. flexible membrane lined
         c. other

2. Liquid waste storage pits
    a. earthen lined
    b. flexible membrane lined
    c. concrete construction
    d. other

IV. Planned Maintenance Activities/Repairs
A. Open Lots
1. Holding ponds
a. with solid settling system (debris basins)
b. without solid settling system
2. Debris basins
3. Pens (solids removal, drain effectiveness)
B. Confined
1. Lagoons
a. earthen lined
b. flexible membrane lined
c. other
2. Liquid waste storage pits
a. earthen lined
b. flexible membrane lined
c. concrete construction
d. other
C. Piping
D. Diversions, Berms, Ditches and Culverts
E. Land Application Components and Equipment

V. Maintenance of Facility When Not in Use
A. Earthen Construction
B. Flexible Membrane Liners
C. Concrete Construction
D. Other
E. Periodic or Permanent Closure Timeline

VI. Record Keeping
A. Disposal Records
B. Repair Records
C. Comprehensive Inspection Record

Nebraska Department of Environmental Quality

ENVIRONMENTAL GUIDANCE DOCUMENT

00-035 July 2001

Sludge Management Plan

The solids and sediments, or sludge, that accumulate in a livestock waste control facility (LWCF) need to be removed periodically. Title 130, *Rules and Regulations Pertaining to Livestock Waste Control,* Chapter 3, requires specific information about monitoring, removal, and land application of solids and sediment, in the form of a Sludge Management Plan, for all holding ponds and lagoons.

Sludge Management Plan Requirements

A Sludge Management Plan must include procedures for periodic monitoring and a schedule for removal and land application of solids and sediment from lagoons and holding ponds. Yearly sludge production can be estimated by using the Natural Resources Conservation Service (NRCS) Agricultural Waste Management Field Handbook, Chapter 10. Typically, the NRCS Handbook provides for 15 to 20 years of sludge accumulation in a design.

Specifically, the Sludge Management Plan should include:

1. A time line for measurement, indicating how often the sludge level will be checked and when the sludge will be removed (winter, spring, summer, fall).
2. If the sludge depth will be measured by use of a staff gauge or marker pole, describe how the pole is marked. For anaerobic lagoons that are not pumped below a minimum treatment level, a staff gauge or marker pole will not be an option for sludge measurement. Several sludge measurement devices are commercially available and may be used, in place of pump-down and visual observation of sludge depths.
3. The method of sludge removal, including a description of the equipment used, and specifically how the liner will be protected during the removal process.
4. Sludge handling procedures, including whether or not the sludge will be land applied at the time it is removed. If sludge will be stockpiled or composted within the feedlot, the area used should be clearly indicated on the site plan as part of the permit application and runoff from the area controlled. If composted, a description of the composting method and equipment used should be included. Stockpiling or composting outside of the controlled feedlot area may result in runoff or discharge in violation of the regulations or permit conditions.
5. A list and description of the equipment to be used, both for sludge removal and for land application/distribution of the sludge, and the capacity of the equipment.
6. A description of the application method and the location where the sludge will be land applied.
7. A description of the sludge sampling and analysis procedures, an estimate of the nutrient value of the sludge, and an estimate of the amount of sludge and sediment to be applied per acre.

9. An estimate of the total amount of time needed to remove, stockpile and/or land apply the sludge, based on the equipment available, the estimated amount accumulated, and travel time.

The Sludge Management Plan must be consistent with the Operational and Maintenance Plan, Closure Plan, and the Comprehensive Nutrient Management Plan (CNMP). Other guidance documents concerning these Plans are available on the Department website or upon request.

Sludge Considerations in the Operational and Maintenance Plan

The Operational and Maintenance (O&M) Plan should include the Maximum Sludge Accumulation Level. This is the maximum level to which sludge will be allowed to accumulate before being removed.

For open lot holding ponds, the maximum sludge accumulation level must allow for the Minimum Design Criteria (MDC) and required freeboard (Title 130, Chapter 1, 036).

For anaerobic lagoons, the maximum sludge accumulation level must allow for the Minimum Treatment Volume (MTV) plus the retention of the 180-day waste storage volume and freeboard (Refer to DEQ Guidance Document, "Lagoon Sizing for Livestock Waste Control Facilities"). Sludge removal can be scheduled for any time before the sludge level begins to impact the MDC (holding pond) or the MTV and 180-day waste storage volume and freeboard requirements (lagoon).

Sludge removal may consist of removing the upper portion of the sludge while leaving the lower portion intact to protect the liner. For earthen pits, sludge removal should be considered part of the routine waste removal for the 180-day storage over the winter months. For anaerobic lagoons that are emptied, note that the MTV must be restored as soon as possible. The O&M Plan should specify how this will be done.

Sludge Considerations in the Comprehensive Nutrient Management Plan (CNMP)

Prior to land application, testing should be done for at least nitrogen and phosphorus levels in the soil. An evaluation of the nitrogen and phosphorus loading on the land application area should be included and coincide with planned land application in the CNMP. Additional management requirements are specified in Title 130, Chapter 11.

Record keeping requirements are outlined in Title 130, Chapter 3, 001.04H and Chapter 11, 006.06 and 006.07. Requirements include estimates and analysis of the nutrient value of the sludge, waste sampling and analysis procedures, the land application rates and locations, and a record of any waste sold or given away.

Questions? Contact: Nebraska Department of Environmental Quality, Agriculture Section, P.O. Box 98922, Lincoln, NE 68509-8922; phone (402) 471-4239. Visit our Web site at **http://www.deq.state.ne.us**.

Nebraska Department of Environmental Quality

ENVIRONMENTAL GUIDANCE DOCUMENT

00-036 March 2000

Closure Plan

Information that should be included:

1. Time line - schedule for activities (include notification to NDEQ when abandonment plan implemented / completed).
2. Dewatering method - equipment, how removed, where applied, etc.
3. Sludge / sediment handling - equipment, how removed, etc. (could refer to sludge plan).
4. Analysis of sludge / sediment / soil liner - at minimum for nitrogen & phosphorus
5. Application method / location - equipment, description of application method (injection, incorporation, etc.), where applied, etc.

Plan could reference normal waste handling practices as appropriate.

Questions? Contact: Nebraska Department of Environmental Quality, Agriculture Section, P.O. Box 98922, Lincoln, NE 68509-8922; phone (402)471-4239. Visit our Web site at ***http://www.deq.state.ne.us****.*

Nebraska Department of Environmental Quality

ENVIRONMENTAL FACT SHEET

00-033 March, 2000

Emergency Response Plan Outline

A. Identify actions to be taken to control and mitigate a spill or discharge of animal waste due to any number of causes including:

1. Power failure
2. Storms or extended wet periods
3. Accidents
4. Equipment failure (including irrigation equipment and components)
5. Failure of components of the livestock waste control facility

B. Reporting of any discharge to the department within 24 hours of the event and written reporting to the department within seven days of the discharge.

C. The department may request rainfall, land application, and storage system records for up to 12 months prior to the discharge.

D. The plan should entail who to contact (i.e. maintenance manager) and what initial steps to be taken in different covered events (i.e. shutting off irrigation pump if land application system fails).

E. Identify any additional corrective and restoration measures.

Questions? Contact: Nebraska Department of Environmental Quality, Agriculture Section, P.O. Box 98922, Lincoln, NE 68509-8922; phone (402)471-4239. Visit our Web site at ***http://www.deq.state.ne.us****.*

Nebraska Department of Environmental Quality

ENVIRONMENTAL GUIDANCE DOCUMENT

00-002 March, 2000

Guideline for Groundwater Monitoring Plans at Livestock Waste Control Facilities

Investigations into local geologic and groundwater conditions at some livestock waste control facilities (LWCF) indicate that a potential for groundwater impact exists. Some of the conditions found to be important include (but may not be limited to) shallow depth to water, sandy or very permeable subsurface sediments, existing groundwater quality, and use of the groundwater as a drinking water source.

This Guideline is meant to be a starting point for the livestock operator/owner, the engineer, and/or other consultant to develop and implement a Ground Water Monitoring Plan and Sampling and Analysis Plan around the waste control facilities. It is only a guideline. When applicable state regulations apply, an attempt has been made to list them here. Reasonable and well-explained plans will be considered, even if they do not correspond directly to this Guideline. This Guideline is set up in question and answer format for quick reference.

Please refer to Chapter 13, Ground Water Monitoring, of Title 130, Rules and Regulations Pertaining to Livestock Waste Control. This Guideline builds on this Chapter from the regulations.

NOTE: Groundwater monitoring may not be required for Class I facilities, unless one or more of the following have occurred (Title 130, Chapter 13, Section 002):

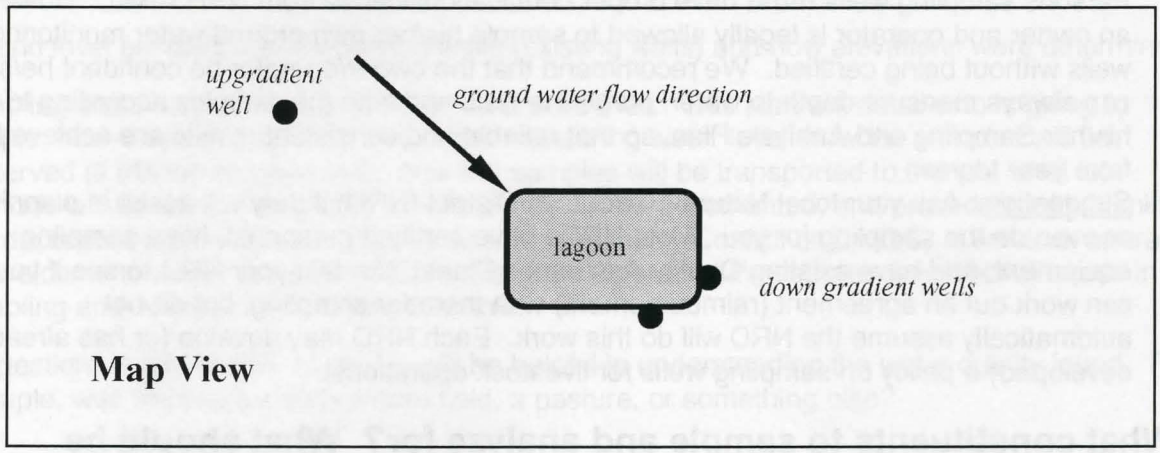
1. a spill or non-permitted release,
2. percolation from the facility exceeds the allowable rate, and/or
3. any other circumstance, which may impact, groundwater quality.

1. How many monitoring wells? How should monitoring wells be constructed?

Minimum of 3 - one upgradient and two downgradient of facility. Larger lagoons or multiple LWCFs may need more downgradient wells. Additional wells may also be needed if groundwater flow direction is different than initially assumed or if the groundwater flow direction is uncertain or variable (by season).

- Surface elevation must be known/surveyed so an accurate groundwater elevation can be determined. Depth to water from the surface is measured before sampling and then that value is subtracted from the surface elevation to give the groundwater elevation.
- Upgradient wells must be located far enough away from the LWCF so that any allowable leakage/seepage will not impact the well (suggest at least 300 - 500 feet away).
- Down gradient wells should be located very, very close to the LWCF so as to detect any possible contamination before it gets too far away (suggest next to berm).

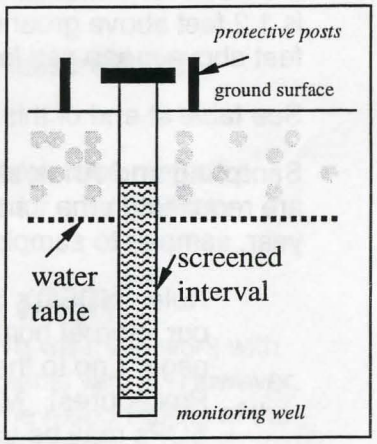
- Ten feet of screen is usually adequate for all monitoring wells.



Depending on local conditions, multi-level monitoring wells may need to be considered.

Existing Wells: If onsite production or domestic well is shallow and have known and proper construction, and depth to water can be measured in it, it **may** be possible to use it for one of the monitoring wells. If you would like to consider using an existing well as one of the monitoring wells, please submit complete construction details (including screen length and placement and gravel pack placement), geologic log, depth to water, and elevation and exact location in your groundwater monitoring plan. We will consider its use as a monitoring well.

Wells should monitor the uppermost part of the water table (generally, the upper ten feet of the aquifer). "Straddling" (i.e. 5 feet above and 5 feet below) the water table is not necessary, unless great water level changes are anticipated during the year.



A licensed well driller (Title 178, Chapter 10, Nebraska Health & Human Services-Regulation and Licensure (NHHS-R&L) must install wells.

Wells **must** be registered (Nebraska Department of Water Resources (NDWR) regulations).

Wells pumping greater than 50 gpm **must** be permitted by the local Natural Resources District (NRD) if in a Groundwater Management Area.

Wells **must** be constructed according to state standards (Title 178, Chapter 12 NHHS-R&L).

- Title 178, Chapter 12, Section 007 has specific details about monitoring well construction. Section 007.04 requires a bentonite seal with a minimum thickness of one foot placed on top of the gravel pack. All monitoring wells shall be pressure grouted from immediately above the bentonite seal to the surface. Section 007.05 requires a mounded concrete pad constructed to slope away from the well. Flush mounted installation with a watertight cap may be used where traffic may endanger the well. Section 007.06 requires above ground steel casing to protect non-steel cased wells completed above ground. Specific well construction questions should be addressed to NHHS-R&L or your well-driller.

2. When to sample, Who can sample?

Twice a year, spring and fall - submit results within 45 days of the sampling event.

- Persons sampling wells **must** have proper certification/license from NHHS-R&L. However, an owner and operator is legally allowed to sample his/her own ground water monitoring wells without being certified. We recommend that the owner/operator be confident he/she can always measure depth to water, purge the well, and take the samples according to his/her Sampling and Analysis Plan, so that reliable and consistent results are achieved from year to year.
- Suggestion: Ask your local Natural Resources District (NRD) if they will assist in planning, or even do the sampling for you. Most NRDs have certified personnel, have sampling equipment, and have existing Quality Assurance Plans. Contact your NRD to see if you can work out an agreement (reimbursement) with them for sampling, but do not automatically assume the NRD will do this work. Each NRD may develop (or has already developed) a policy on sampling wells for livestock operations.

3. What constituents to sample and analyze for? What should be reported?

Measure depth to water before purging and sampling.

Nitrate, chloride, ammonia (report analysis methods used by lab along with results and units, i.e. mg/l).

Report depth to water and analysis results to NDEQ within 45 days of sampling. In the first report, include as-built monitoring well construction details, elevation, and geologic logs. Also describe the water level measuring point, i.e. "Depth to water is measured from the top of the casing, which is 1.2 feet above ground level. This ground level was surveyed on 11-3-99 and found to be 1244 feet above mean sea level."

See table at end of this Guideline for suggested reporting format.

Sampling and Analysis Plan, Standard Operating Procedures, Quality Assurance Plan or similar are required (in the changes to Title 130) to ensure consistent sampling and analysis from year to year, sampler to sampler.

> Note: NDEQ's Standard Operating Procedures (SOPs) for sampling wells are published on our internet home page. Please look at **www.deq.state.ne.us** (to find them on our web page -- go to the Site Map, then to the Groundwater Section, Standard Operating Procedures). Many of these SOPs will not apply to sampling at livestock facilities. NDEQ's SOPs may be used as is, with changes, or by reference in a livestock operation's ground water monitoring plan. If you do not have internet access, we can send you the SOPs.

4. What do I need to include in a Groundwater Monitoring Plan?

A site map, to scale, with proposed monitoring well locations clearly identified. If map is not drawn to scale (Class I facilities), indicate distances between important points, such as monitoring wells and lagoon. Indicate north on the map, as well.

Approximate total depth, construction details, and screen placement of proposed monitoring wells.

Construction details of existing wells (see above), if you are proposing to use them as monitoring wells.

Indicate who will do the sampling (owner/operator, consultant (name and address), NRD, etc.). If the NRD will do the sampling, please include a letter or written statement from them indicating such agreement.

Ground level elevations of monitoring wells (existing wells) and how elevations were determined.

Sampling and Analysis Plan or Quality Assurance Plan. This plan will detail who is going to sample, how they will purge the wells after measuring water level, how the samples will be preserved (if the lab requires this), how the samples will be transported to the lab, what lab methods will be used, how the chain of custody will be documented, and procedure with blanks and duplicates (also known as Quality Assurance/Quality Control or QA/QC). Livestock operators are welcome to adopt or adapt NDEQ's Standard Operating Procedures (see above) to use in a Sampling and Analysis Plan in part or whole.

Suggestion: A site history summary will be helpful in understanding the water quality found. For example, was the site formerly a corn field, a pasture, or something else?

5. Is there any way to avoid groundwater monitoring?

NDEQ reviewed available information from the permit application, nearby registered wells, University of Nebraska maps and geologic well logs, U.S. Geological Survey maps, soil surveys, and other data to make a preliminary recommendation of requiring ground water monitoring. The livestock operation may submit information to NDEQ for consideration to support a contention that site-specific conditions would be protective of ground water and that ground water monitoring may not be necessary.

The submittal **must** be site specific and may include, but is not limited to:

- detailed geologic logs from onsite test holes, drilled to groundwater;
- local ground water flow direction map, derived from local water well measurements;
- local survey, showing groundwater use in area; and
- other appropriate information.
- **NOTE:** Information about the financial ability of the owner, or the construction method or size of the LWCF is NOT taken into account when reviewing facilities for groundwater monitoring requirements.

6. After I submit the groundwater monitoring plan, then what?

The Groundwater Unit will review the plan and determine if it is adequate. We will try to work with livestock facility operators to come up with an acceptable plan if we find problems with it. However, it should be made clear that an acceptable ground water monitoring plan is the responsibility of the facility. Official notification of plan acceptance will come from the Agriculture Section.

Questions?

Groundwater Monitoring Questions:
NDEQ - Groundwater Unit
(402) 471-0096

Well drilling/sampling certification/licensure and well construction:
Dave Cookston, NHHS - R&L
(402) 471-2541

Permitting:
NDEQ - Agriculture Section
(402) 471-4239
NDEQ - North Platte office
(308) 535-8142

Well registration:
Susie Berlowitz, NDWR
(402) 471-2363

Nebraska Department of Environmental Quality

For further information about the livestock, ground water or other environmental programs, contact NDEQ at

1200 'N' Street, Suite 400
PO Box 98922
Lincoln, NE 68509
402/471-2186
-- or visit our web site at www.deq.state.ne.us --

Sample **Livestock Ground Water Monitoring Data Report** **12-1-99**
XYZ Livestock, Inc. Butler County
For samples taken 11/22/99, delivered to lab 11/23/99
Lab Work Inc, David City, Neb. report dated 11/29/99

Well number	DWR Registration Number	Depth to Water, feet from top of casing (prior to sampling)	Nitrate-N, mg/l	Ammonia-N, mg/l	Chloride, mg/l
MW-1	G-123456	22.5	5.6	<0.1	12
MW-2	G-123457	21	2.4	<0.1	14
MW-3	G-123458	20.8	4.7	0.2	20
Duplicate QA Sample, MW-2		21	2.3	<0.1	17
Blank		Na	<0.5	<0.2	<1

Samples taken by George Johnson, certified water well monitoring supervisor certificate 123456, employee of Consultants Corp. Inc., David City, Neb.

Analysis	EPA Lab method number	Method Detection Limit (MDL)	Reporting Limit (RL)
Nitrate-N	xxx.3	0.5	0.5
Ammonia-N	xxxx.5	0.1	0.1
Chloride	xx.2	1	1

Notes:
Lagoon pumped 2 weeks prior to sampling event.
569 cattle in facility, currently.
3 well volumes pumped from each well prior to sampling.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in Cooperation with the U.S. Department of Agriculture. Elbert C. Dickey, Dean and Director of Cooperative Extension, University of Nebraska, Institute of Agriculture and Natural Resources.